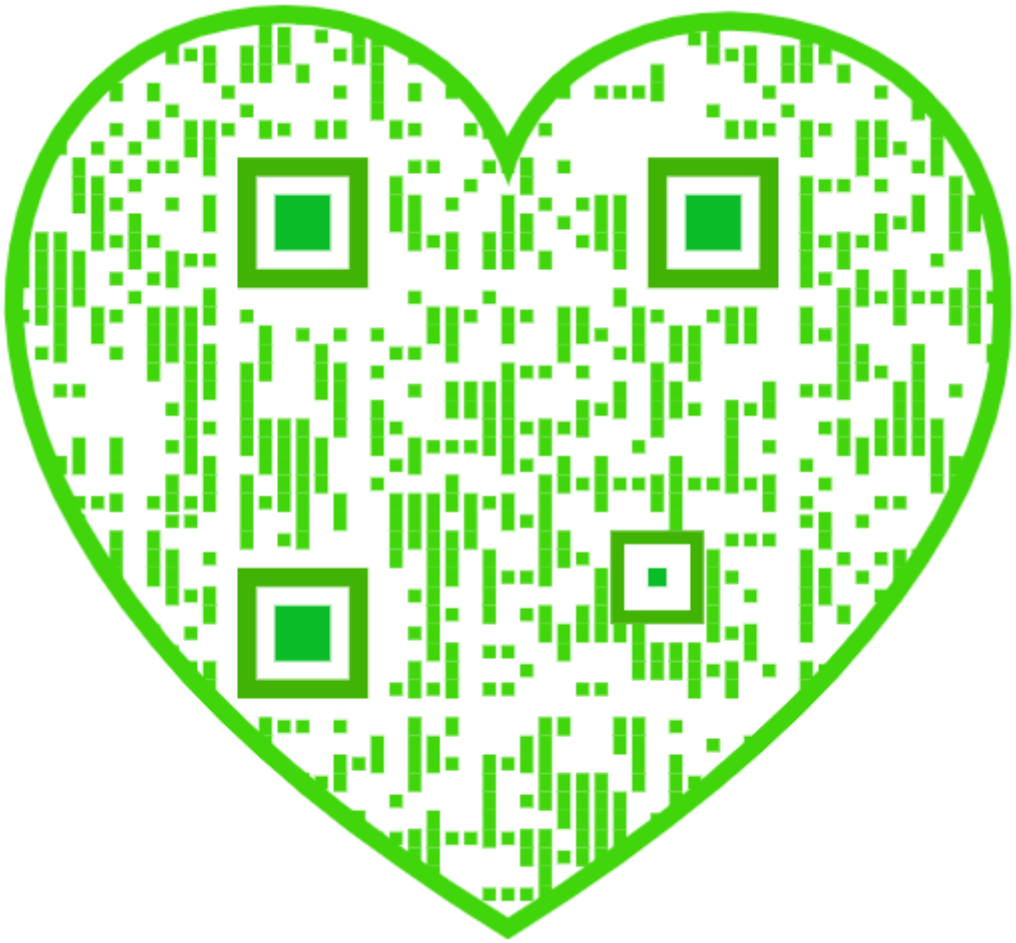

1628

THE POTATO

RESCUED FROM DISEASE, &c.

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THE POTATO

RESCUED FROM DISEASE, &c.

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THE

POTATO

RESCUED FROM DISEASE, AND RESTORED TO PRISTINE VIGOUR,

BY A

PLAN OF KEEPING AND CULTIVATION FOUNDED ON THE NATURAL PRINCIPLES OF THE VEGETABLE ECONOMY.

By WILLIAM AITKEN,

CASTLE-DOUGLAS.

WILLIAM BLACKWOOD & SONS, EDINBURGH;
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PREFACE.

Most literary productions are ushered into the world with a preface, very frequently couched in the language of apology. Could the author of the following treatise flatter himself that the propriety of this attempt to serve or promote the interests of his country was ultimately to be equalled by the *success* he anticipates of his recommendations, he should deem a single word of apology unnecessary. The subject, the Disease of the Potato, being nationally important, is one on which *any* person may claim a hearing,—on which, indeed, every one ought to be heard who professes to be able to assign a remedy for its removal.

When the taint first made its appearance, a host of conflicting opinions were immediately set

afloat as to its origin, and almost every newspaper teemed with remedies, most of which being opposed to each other in essential particulars, were therefore unsatisfactory.

My habits as a Nurseryman and Gardener prompted me, at an early period, to the investigation of all the facts in the cultivation of the Potato which fell under my own observation, or were supplied by friends in whose judgment and veracity I could confide. The results of these observations are embodied in this small volume.

For that part of my treatise not immediately bearing on the diseased state of the potato, I do not consider myself bound to apologise, as it must now be obvious to every reflecting person, that too little attention has hitherto been given to the natural or acquired habits of the potato; and that to the unskilful management to which it has so long been condemned may almost confidently be attributed, to a great extent, the present precarious state of its constitution. Many of the rules I have laid down will, I doubt not, be at once received as self-evidently just, and acted

upon without a moment's hesitation. Others *may* be questioned at first; but the propriety of which, I have no doubt, after a mature consideration of the nature of the subject, will be as readily admitted. There is not a single hint contained in the volume but is either the result of experience, or has been suggested by experiment upon plants, whose nature and general habits are strictly analogous to those of the potato.

Should I have been fortunate enough to have detected the cause or causes of the taint,—which may still be a question with some, although in my own mind I am satisfied,—and should I have pointed out such modes of treatment as will have a tendency to arrest its progress, my highest object will have been attained. To the merits of literary composition I lay not the slightest claim, and therefore hope to escape *much* severity of censure. My chief desire has been to be of service to my brethren who till the soil; but, should my duty on the occasion minister to my interest through the medium of public patronage, I shall find no difficulty in being suitably grateful.

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CHAPTER I.

THE EARLY HISTORY OF THE POTATO—ITS GREAT IMPORTANCE, DOMESTIC USES, HABITS, AND FAVOURITE SOILS.

The potato, in its utility to the world, may not inaptly be compared to any of the most common elements of nature, which, while enjoyed in abundance and no doubts are entertained of their continuance, we appreciate too lightly their invaluable properties.

Although the potato, in consideration of its constituting so important an article of human food, may now be fairly included in the list of indispensables; its introduction into this country is nevertheless of comparatively recent date. Only two centuries ago, it was retained in botanic gardens as a curiosity.

Gerard, Queen Elizabeth's gardener, and the celebrated Sir Walter Raleigh, obtained it from Virginia, about the year 1586; and, it appears, that it was first cultivated for use on Sir Walter's estate of Youghall, near Cork, whence it was propagated through Ireland, and used as food, before its value came to be understood in England.

Although we received it from Virginia, it does not follow that the potato is indigenous to that country. Botanic works mention it as a native of Peru. Chili, in South America, has also been assigned as its native country, a fact established by recent travellers, who have discovered it growing there in its wild state, and where the blossom is invariably white. Sir Joseph Banks is of opinion that it was first brought from the mountainous parts of South America into Spain, in the early part of the sixteenth century, and from thence transported to Italy, where it was early cultivated. It appeared at Vienna in 1598, which was twelve years posterior to its appearance in Britain; and was procured from Italy from an attendant on the Pope. It would thus appear that the potato was introduced into several kingdoms of Europe much about the same period; but it is evident that, in regard to Britain, its worth was not duly appreciated, nor was it brought into general use, until many years after its introduction. Indeed, from the apparently natural antipathy of mankind to every thing beyond the range of their former experience, the poor potato, like every other innovator, had to suffer innocent persecution through a period of one hundred and fifty years: and this not in Britain *alone*. In other countries, in France, Spain, Portugal, and Italy, it had to struggle against similar prejudices. It is affirmed that in Naples, not more than half a century ago, when a ship-load was sent for the relief of the wretched inhabitants, during a season of famine, they chose rather to perish than have re-

course to the hated root as an article of food. They have since grown wiser. Still the potato is not the favourite in those countries that it is now in Britain. Several writers have, at different periods, lent their aid in heightening the popular prejudice so long entertained against the potato. An author of our own country, Green, observes, that attempts were made to persuade the good people, that it was a most noxious root, and had a manifest tendency to produce insanity; while others give it as their decided belief, that to the use of it might be attributed the prevalence of that most loathsome disease, leprosy, against which there is no reason to doubt it was a powerful remedy. In spite, however, of ignorance and prejudice, the more wise and rational conclusion, the result of careful experiment, came to be universally established, that it is equally valuable whether viewed in the light of food for man and beast, an improver of the soil, or an article of immediate profit to the cultivator.

Loudon, the voluminous writer on gardening and husbandry, says, that potatoes were first cultivated in gardens in Scotland in 1740; but not in fields until 1760. From a local work, however, we find them earlier by fifteen years. In a letter from the late J. Maxwell of Munches, to W. M. Herries of Spottes, dated 8th February 1811, and published in the Stewartry of Kirkcudbright Agricultural Society's Report of that year, it is stated that "Potatoes were first introduced into this stewartry in 1725, by William Hyland, who carried them on horses' backs to Edin-

burgh, where he sold them by pounds and ounces." About the time of its first introduction into Scotland, qualities seem, as in other places, to have been very much underrated. In 1708, it is thus mentioned in Mortimer's Gardener's Calendar, "The root is very near the nature of the Jerusalem Artichoke, although not so good and wholesome, but it may prove good for swine;" a sage prediction—which has been fully verified. Perhaps much of this reluctance to acknowledge the merits of the potato, ought to be attributed to the *then* imperfect mode of culture to which it was subjected; or, it is not improbable, that the intrinsic quality of the root was not equal to what it afterwards became when fully naturalized to the soil. A person who had been invited to taste the first potatoes which had been planted in the county of Forfar, in or about the year 1730, related that the roots had been merely heated, and that they adhered to the teeth like glue, while their flavour was far from agreeable. The poor potato, was about to be condemned from the ignorance of the cook, when the accidental arrival of a gentleman who had tasted a potato in Lancashire, caused the rejected roots to be sent back to the hot turf ashes, until they became as dainty as they had before been nauseous. There is another jocular anecdote, noticed by several authors, which may be here noticed. It is said that Sir Walter Raleigh's gardener, having reared the plant, according to his master's directions, presented him with some of the apples, asking, with emphasis, if *that* was the fine fruit he had anticipated? Sir Walter

having examined them, feigned dissatisfaction, and ordered the gardener to *root* out the weed; which he did, as desired, and found a bushel of potatoes as the produce of the plants.

The culture of the potato had certainly made considerable progress in Ireland long before its general introduction into England or Scotland. It was to a day labourer of the name of Prentice, living near Kilsyth in Stirlingshire, that the Scotch were indebted for the first instance of successful cultivation of potatoes. In 1728 this man, having obtained a few roots, planted them in his garden. They grew and multiplied; and for many years, by industrious management, he not only raised a sufficient supply for himself, but was able to spare small quantities to the surrounding country. The year 1740, so long remembered in Scotland as a season of peculiar severity, gave the first impulse to the cultivation of potatoes. Prior to that date, it had been recognised as a valuable auxiliary of food, and the dread of the recurrence of a similar calamity led to a more general and extensive cultivation of what promised to be the most effectual remedy against such a visitation. Its progress, however, both in Scotland and England was still slow. Many circumstances combined to render it so. Drill husbandry was then unknown; and consequently the process of rearing it by the spade alone, required more time and greater exertion, than the slovenly farmer of that period was willing to submit to; and, moreover, it was not understood or generally believed, that the potato could be preserved

in any other way than by allowing it to remain in the earth where it had grown; and from this circumstance the production of any very considerable quantity was never contemplated; so that it was not until the principles of farming came to be better understood, and more successfully practised throughout Scotland, about the year 1790, that the potato excited that degree of attention to which its intrinsic merits entitled it. In Millar's day, and when he published his latest edition of the Dictionary of Gardening and Husbandry in 1750, they were cultivated in the fields near London. Only two kinds were then known; a red and a white. The first variety that my researches enable me to localize to this district was white, which was named *Swatterochs*, from their being of small size and great number. This information I obtained from two very old people; one of them a female in the village of Dalry, who is now 105 years old. The white were supplanted by a small blue, and by several varieties of a kidney shape. A large new blue, which was hailed as a great acquisition, was introduced about the year 1785, or fifty-two years ago; which is considered to be the same blue kind still in use. Since then, the staple produce has been much improved, by raising new kinds from seed; comprising lates and earlies, of many different sorts. This improvement has chiefly taken place within the last twenty-five or thirty years, and has added incalculably to the value of the potato, by extending its use throughout the whole year; not only at table, but as food for almost every description of cattle. Lou-

don, in his Encyclopædia of Gardening, published in 1822, gives thirteen sorts of early, and fourteen of late, as good and well selected kinds. It was not till after this, and similar attention had been paid by scientific individuals, that the full value of the potato was universally understood, and the production of it became of such paramount consideration.

Thus much in regard to the *history* of the potato. I shall next offer a few observations in regard to the various *uses* to which it has already been or may be adapted.

The domestic purposes to which the potato may be applied are various, but the most beneficial and universally useful one, is that of wholesome nutritive food, readily procured by the simplest operation of cookery, namely boiling. Simple, however, as this process is considered, it is amazing, as is quaintly observed by Green, that, considering the universality of the practice, so great a majority of those who undertake to boil potatoes seldom fail to spoil them. To boil potatoes as they ought to be boiled, select them as nearly of a size as possible; put them into a pot, and cover them with cold water; throw in a handful of salt, place them on the fire, and cause them to boil as soon as possible. When once brought to the boil, do not hurry the process, and be sure to place the lid so as to admit the free evaporation of the steam, which prevents the potato from falling to pieces. When done enough, which will be the case in fifteen minutes after they have come to the boil, pour off the water, and again place them upon the fire for ten

minutes, with the lid still placed to the one side, in order to dry them sufficiently, when they will be fit for use, and then they should be *immediately* used. When cooked with the skins off, which is a very judicious and prevailing practice, the following particulars should be attended to. Pare off the skins as thinly as possible, the exterior or surface being by much the richest part; divide the large ones down to the medium size; then wash them clean, and boil them as before directed. When boiled sufficiently, pour off the water, and putting the pot upon the fire for about five minutes, throw in some salt, and shake the pot as to move the potatoes, until the steam shall have evaporated. At this stage of the process they are ready to be used either whole, or to be pounded with a wooden pestle, in order to be served up under the name of "*beat* potatoes;" one of the most delicious dishes into which the potato can be formed, and which is very common in the districts of Dumfriesshire and Galloway. The manner of preparing "beat potatoes" in those districts is to pound them with a wooden pestle till they are completely broken, and then adding salt-butter, and a suitable quantity of milk, and stirring them with a wooden pot-stick till they assume the consistence and appearance of a fine flour pudding. Some use a piece of finely flavoured old cheese; or when milk is scarce, substitute beat-eggs, mixed in a little warm water, to reduce them to the proper consistence; and, as *kitchen* use, a mixture of brown sugar, or treacle and water. Thus prepared, there is no kind of food more grateful to

the palate to which it has been accustomed. Many of the natives of Dumfriesshire and Galloway, who have resided for years in foreign countries, have been heard to declare, that the recollection of the savoury "beat potatoes" continued to haunt them with the most provoking pertinacity, even while indulging in the more refined luxuries of the East. Roasting them in a slow fire, amongst peat-ashes, is not only the earliest method of cooking them, but the process is recommended as being the most effectual in preserving the original flavour of the potato. The inconvenience, however, of cooking them in this manner, to any extent, will prevent its being generally resorted to. Preparing them by steam is another method now much in use; but it is doubtful if, after all, there has yet been discovered any better mode of cooking than that of simply boiling; as it is said to carry off some matter, which, when allowed to remain, is thought to injure the *flavour* and even the wholesomeness of the root. There are many other modes of cooking this root besides those above-mentioned, which it would be superfluous to enumerate; as any one of them, if skilfully practised, will answer the purpose of procuring a wholesome and delicious dish. The potato can only be spoiled by sluttishness and neglect.

A fine flour may be obtained from potatoes in the following manner: Wash them well, and grate them to a pulp by a grater or hand-mill, for the purpose. Put the pulp into a hair-cloth, and repeatedly lave it with cold water, till the strainings are clear, and the fibrous parts are perfectly divested of the floury sub-

stance. The former may be set aside for the nse of cattle, and the stirred liquor suffered to settle; after which, the brown-coloured water is poured off, and fresh water again and again mingled with the sediment, until it becomes perfectly pure. The sediment is then dried in the sun, or in an oven, as quickly as possible, that it may not become sour. It will keep many years if preserved dry. The quantity of flour thus afforded will depend on the kind of potato from which it is extracted, some potatoes being much more farinaceous than others. In general, one pound of flour may be obtained from seven or eight pounds of potatoes. By this process, the potato is deprived of the greater part of the soluble mucilage, which is also nutritive, but which it is necessary to remove in order that the farinaceous, or durable portion, may be rendered capable of preservation. Potatoes, rendered otherwise useless from frost, may, by this means, be saved from entire loss. The only objection against working up frosted potatoes in this manner is, that the season at which the frost takes place, the flour can be dried *only* in an oven, which would be tedious and inconvenient. The only time when flour can be made of potatoes, so as to be profitable, appears to be the month of June, and in such years only as there is a superabundant stock of old potatoes.

Yeast or barm may also be obtained from potatoes. The operation, as described by Green, is simple:— Boil a pound of potatoes for every quart of barm to be made, until they are quite soft; skin and mash them very smooth; mix as much water in that with

which they were boiled, as will reduce them to the consistency of common yeast, not thicker. Add to every pound of potatoes, two ounces of coarse sugar or treacle, and, when lukewarm, stir in, for every pound of potatoes, two table-spoonfuls of good new beer yeast; keep it warm, stirring it frequently for twenty-four hours, or till it has done fermenting, when it will be fit for use. It will keep three months in bottles.

Spirits may also be obtained from potatoes. It was tried in Sweden, in order to save corn; and it is said, that an acre of land planted with potatoes, was found to yield a greater quantity of spirits, than if it had been sown with corn or barley. The practice was also tried in Scotland, and with different degrees of success, owing, no doubt, to the different degree of care and attention bestowed on the process. From seventy-two pounds of potatoes, an English gallon of pure spirits, considerably above proof, and about a quart more below proof, was the result. It was celebrated as the finest and most agreeable vinous spirit ever tasted. The operation is this:—The potatoes were boiled to a pulp, bruised, and pressed through a sieve, with fresh water, to separate the skins. The pulp was then gradually mixed with about twenty gallons of cold water, yeast was added to this mixture, at a proper temperature, and in ten or twelve hours, a fermentation began, and continued for about that time; and was then renewed, by stirring it briskly at the same intervals, for a fortnight, at the end of which time it could not be renewed by agitation or otherwise, and was found, upon trial, to

have acquired a kind of acid and slightly vinous taste, fit for distillation. It was then cautiously distilled, taking care to stir it till it began to boil, before the still-head was applied. This experiment has been found to succeed upon a second trial, and no doubt now remains of the practicability or success of the operation.—Thus, having shewn the various uses to which the potato is applicable, I shall now proceed to describe its *habits*.

The potato belongs to the genus *Solanum*, or nightshade, and species *tuberosum*, *i. e.* the tuberous-rooted nightshade. The general qualities of the family are of a highly poisonous nature; yet it has afforded to the world a useful individual, which only in leaves, stems, and skin of the tubers, is said to possess a family relation. In habit, the potato shews itself to belong to a hotter climate than ours. It is impatient of frost. If the tubers are imbedded in their natural element, the earth, they will not venture to spring up until the season arrives when they may do so with probable safety. They agree uncommonly well with heat. It is always in a warm season that, if supplied with sufficient moisture, they yield the most abundant crop. They cannot, however, live in a superabundance of moisture; flooding in summer being almost sure to destroy the crop. They stand high winds very ill, consequently shelter is of material advantage. They retreat at the first appearance of autumn frost, although, by proper management, they may be generally matured in this country ere its arrival. Notwithstanding its aversion both to frost and excessive moisture, it is by nature capable

of suiting itself to a greater variety of climate than most other plants. It is grown with success in every region of the globe. In this respect it far outdoes its cotemporary, the *Convolvulus batatas*, or sweet potato, which was introduced into Britain much earlier than the other, but which will not thrive in our climate, unless under the protection of glass, although it succeeds very well in Spain, the south of France, and in the United States of America. Our potato, however, though a native of the tropics, must at the same time be an inhabitant of high localities, in order to fit it for such a climate as ours. As has been formerly observed, it has been discovered in its wild state among the mountains of Chili and Peru.

As with climate and soil, so it is with manure. The potato accommodates itself remarkably to expediencies. It refuses no particular kind of manure. With any, or with none at all, according to circumstances, a tolerable crop may be produced. Nevertheless, there can be no doubt that the *kind* of dung, the quantity, and the manner and time of applying it, will have a material effect both upon the quantity and quality of the root. From a moderate application of well prepared dung, on a dry kindly soil, the best quality of potatoes may be expected. But if the land is rich, and of a soft loamy or mossy nature, the greatest attention may be necessary. By overdunging such soils, though the crop may be abundant, the quality will to a certainty be coarse and ill-flavoured. Hard sandy or gravelly soils will stand a larger quantity of dung, or rich compost, than those

of a soft and loamy nature. If ground be newly trenched, and a large proportion of subsoil turned up, there is little danger to be apprehended in regard to the quality of the potato, as the virgin mould will readily absorb such proportion of the manure as the natural demand of the potato may not require.

It is the opinion of most cultivators, that the potato finds itself most at home in a light loam, considerably within the extremes of either drought or moisture. But, in conformity with its *generally* accommodating habits, it will readily, under skilful management, suit itself to any soil upon which other descriptions of crop can with propriety be cultivated. A stiff wet clay is the only one to which it manifests a decisive antipathy; here it will vegetate, and in seasons of unusually fine temperature, may even reach to something not distant from an average crop of more suitable soils, but such is the risk of failure, even under the most careful and judicious mode of culture, that it will be found imprudent, by most individuals, to push the matter farther than may be necessary for the sake of experiment. For early kinds, warm, sandy, or free earthy soils answer best. All kinds shew great partiality to virgin soils. In Argyleshire, they attribute their freedom from the curl to the changing of the sets very often, and planting them on newly improved grounds of a mossy quality. This, says Green, is a strong inducement to cultivate such waste lands.*

* This would afford a fruitful subject, on which I might expatiate at any length, were it not a digression from the subject

The potato thrives amazingly on a well-drained moss, slightly mixed with clay, sand, till, or gravel. From such a commixture the very finest crops are

in hand. Could my feeble pen only turn the attention of the British public to a matter of such vast importance as the cultivation of the immense tracts of bog-land with which all the three kingdoms abound,—but, in particular, my own beloved land of the mountain and heather, and her ill-starred sister, the "green isle of the west,"—with what pleasure should it be wielded in the cause! The magnitude of the theme, however, is overwhelming. There have they lain from the creation till this day, each, or, at least, many of them, containing a treasure within their bosoms, and yet are they unwooed, and, of course, unwon. The cry is, "The people have procreated sons and daughters until the demand for food has outgrown the supply." I would ask, Is any person entitled to say so as long as probably a sixth part of the whole surface, capable of bearing abundant crops, is lying in a state of unbroken sterility? Surely there are ways and means through which the proprietors could, with perfect impunity to themselves, set to work upon such wastes the millions of wretched beings who at present are enduring the dreadful consequences of idleness, or unrequited labour. To such beings themselves existence is a curse; and, to the society upon whom they hang they are a calamity, which, if allowed to increase in its natural ratio, will in time pull the machinery of society to pieces. There may be a point at which, even in the best cultivated countries, population is *fated* to stay its progress; but I am yet to be convinced, that it is the interest of any country to allow that period to be antedated, by refusing to fertilize its own soil by the hands of those to whom it has given birth. In the advocation of such a cause I waive theory. I also waive expediency. It may be true that the advantages accruing to the proprietor from the cultivation of the bogs of Ireland may be remote. I only ask if the thing be practicable, without bearing hard upon his present finances? Is the answer affirmative? In that case, I call upon his patriotism, his humanity, his christianity; and, under the sanction of these, I would urge him to attempt it.

often turned up, and seem to tempt the hand of industrious enterprize to extend their breadth.

To conclude this part of my subject: All-accommodating as the potato is in its habits, still, no plant exhibits a larger share of gratitude for kind and attentive management. No other plant has a greater abhorrence to whatever tends to obstruct the spread of its roots. Wherever the soil has an aptitude to bear heavily down upon its subsoil, or wherever it becomes interwoven by the roots of fibrous weeds and coarse grasses, unless care be taken to counteract the one by sufficient pulverisation, and entirely to remove the other by weeding, it is perfect folly to look for a remunerating crop. Indeed, the nature and general habits of this, the most useful individual among all the generations of tuberous vegetables, is yet but imperfectly understood by the mass of ordinary farmers. Few of them prepare the ground as it ought to be for its *reception;* and an equally small number seem to be aware of the kind of treatment under which alone it is enabled to exhibit itself in full perfection. It is only *now and then* that we see a very good crop of potatoes. Let farmers be at pains to have their potato fields made perfectly clean, and to keep them so,—let them attend to the instructions of scientific men in regard to the management of their dunghils, or, let them become scientific themselves, and let them act judiciously in the selection of varieties for seed; and in all ordinary cases, unless they bury them in water, or allow them to lie uncovered on the surface, they will seldom fail of having a good crop.

CHAPTER II.

DISEASES OF THE POTATO—FATAL PECULIARITIES OF SUCH, AS LATELY EXHIBITED.

In looking into the several authors who have written on the potato, I find them all taking notice of the *curled leaf*, as the only disease to which, up to a late period, it had been liable. It was very general about the year 1820, when it had extended over almost the whole of England. It also appeared in Scotland; but, as far as I have learned, never did much injury in this part of the United Kingdom. Its progress, like that of the present disease, was marked by certain phenomena which could not be accounted for upon any known and acknowledged principles. It always appeared first, and was most destructive, upon early and fertile soils; while the cold upland districts seldom experienced its ravages. One field in a district, and one part of a field, would be often infected, without its being possible to say why it so happened, or how another beside it should have happened to escape. At the time when Green wrote, it was very prevalent. He assigned for the disease a number of very unsatisfactory causes. It was evident, indeed, that he did not understand either the disease or the remedies. Some

of the causes to which he assigns the curl may, however, be worth notice. The 3d is souring the plants from which the sets are taken, by too much fresh dung; and earthing them up too deep in land too rich, and taking sets from tubers rendered large by such management. 4th, Planting the same sorts too long on the same land. 5th, Taking the sets from tubers heated or frosted. 6th, The first shoots being broken off before planting, by which means the sets are weakened. Mr Marshall, he says, adopted the idea, that the old varieties formerly in use dwindled in produce until they were entirely worn out with disease, that new varieties were introduced, and that the disease vanished with the old ones. He gives an instance in confirmation of this; and further adds, The circumstance of the old sorts being now almost entirely cut off by the curl, renders it probable that curl is incident to declining varieties of potatoes, as canker is to declining varieties of fruit. This last remark I consider to be correct, that the curl has its origin from decay, by age, of the kinds; and that the third, fourth, and fifth causes assigned, would all, or any of them, have a tendency to promote or hasten the curl. Others of his causes are of a trifling nature, and only shew his vague and uncertain knowledge of the subject. He recommends changing the seed from cold, late, and clayey soils, from newly broken up land, or from moss or moor, or any change whatever from a worse to a better soil.

Loudon, who writes much later than Green, takes nearly the same views. He says, that in Lancashire

and Yorkshire they brought changes of seed annually from Scotland, which had a good effect; and that, when the disease appeared in the Lothians, they procured changes of seed from the northern counties. Ultimately, he adds, it was discovered that every farmer could have a change, by planting late and raising early on his own farm, from land not strongly manured. It thus appears, that, although the remote causes of the curl were never fully discovered, yet a remedy was found in the simple expedients of changing the seed from one district to another, or, which was probably a more effectual method, raising new and natural, and, consequently, more vigorous varieties, immediately from the plum itself. Both of these practices, particularly the latter, can never be too frequently resorted to, even although there should appear to be no pressing necessity for either.

Although unnoticed by the authors I have perused, I learn that a disease termed the dry-rot, appeared among the potatoes on different farms in Ayrshire. A farmer from that quarter with whom I conversed, says about twenty years ago he lost almost his entire crop. The disease infected the stores in houses or pits during winter, and if not observed and the infected separated from the sound, the whole very soon became an entire mass of corruption, and were rendered unfit for any purpose. When once the disease entered a farm, it increased until an entire change of seed was introduced, which invariably proved a cure; this once understood, the evil was

soon got over. It also appeared only partially, and on farms where the same kinds had been long used.

We now come to treat of the disease now almost universally prevalent, and which, under its present aspect, threatens nothing less than the utter destruction of what may be pronounced the staple food of a large proportion of the population of Scotland and Ireland. Its appearance is recent, and therefore ill understood. I have not been able to trace it further back than to 1831. Like the curl, it was first observed in the most fertile and best cultivated districts. It spread rapidly, however, and soon invaded every district, and every description of soil. The failure of 1835 was more general than that of any previous year; few fields escaping the disease in a greater or lesser degree. The last season, however, has assumed a still more alarming appearance. The crop of 1836 was comparatively a complete failure; and should a remedy not be speedily discovered, a few seasons more, supposing the disease to increase in the same ratio as in the two last years, and it is obvious that the potato, as food for the common people, must cease to exist. From the universal anxiety to discover the cause of the disease, and to apply remedial measures, the subject has been often brought before the public by the various journals of the day; and, as might have been expected, a Babel-like confusion of conflicting opinions has been the result. Among the many, however, several very judicious essays have appeared, which confer much credit on the writers. Others have been less successful; and the

result is, that the public, betwixt so many contrary opinions, are left in uncertainty how to proceed. Indeed the phenomena of the disease have been so capricious, that they tend to haffle every explanation given of them. Some writers have supposed that they had detected the evil in the soil; some in the manure, and others in the seed; such as arising from heating the seed in the house or pit, raising it before it had become thoroughly ripe, and various other causes; in none of which cases can it be affirmed that the explanations have been fully or even partially borne out. If the seed, for instance, received injury from heating, it would all fail alike, as far as so injured and no farther, in the same manner as heated oats or other grain fail when used as seed. But this is not the case with the potato: only a part fails; so many days' planting, or a part of one day's planting, while others of the same seed succeed; or, if certain kinds all fail in one field, they succeed in another; or if they failed at one time, the same ground at another time has been planted with a reversion of the same seed, which has succeeded. I had a particular instance related to me by Mr James Webster, gardener at Mnnches. It was on the farm of Butterhole, in the parish of Buittle, and occurred in May 1832. A part was planted in the morning, and covered in before ten o'clock; another portion was planted and covered in about noon; and a third quantity was planted and covered after four in the afternoon. The mid-day planting only failed. The weather was at

the time very hot; and the ploughman observed, that, at the time he covered the mid-day planting, he felt the ground to be very warm under his feet. There are other equally mysterious failures, which might be quoted. Last season, when the weather was uninterruptedly dry, the failures often became total. In other instances, such as were planted, first in the morning, immediately after the seed was taken out, partially succeeded; but all planted later in the same day, after the ground became heated, totally failed. At other times, those planted on damp well rotten dung succeeded, when planted at any period of the day, while such as were planted on dry dung, or dry ashes, failed totally, at whatever time of day they happened to be planted. Sometimes those planted below the dung succeeded, when, in the same field, and in same day, the same seed failed when planted above the dung. Sometimes the failure in one setting was total, at other times only partial. If two or more kinds of seed were mixed, one kind failed while the other succeeded. I knew an instance of flat-reds and a large white kind being mixed; the reds failed totally, and the other grew and turned out a good crop. The one end of drills will fail, when the other end will succeed, but this has most frequently happened when there was a change of soil. Last season, when the weather was dry, the damp end of a drill succeeded, when the dry end failed, and *vice versa* in former seasons, when the weather happened to be wet. It is worthy of

remark, that in no season, if the weather was wet at the time of planting, have the failures been so general.

The greatest failures have been from cut seed, which is generally used in this country. When planted entire, they have very generally succeeded, but not in all cases; there have been partial failures even from entire sets, both in this country and in Ireland. I have seen some planted whole which have grown, but the plants were much infected with curl. It appears then, that planting with uncut seed, unattended with other circumstances of precaution, is not an infallible cure.

The disease attacks the seed, apparently, soon after it is put into the ground. Its effects become quite perceptible, upon examination, in from ten to fifteen days. It is then easily distinguishable from sound seed. The decay begins on the cut side, and proceeds outwards, and when broken there is generally found to be about one-eighth of an inch sonnd nearest the skin. The diseased part loses the natural appearance, and assumes a dun or snuff colour. In this state the eye of the set frequently produces a feeble unhealthy shoot, which sometimes supports itself from its own roots; but more frequently the shoots partake of the appearance of a runner, with a small tuber forming on its top. When whole potatoes are diseased, they produce such runners, and small new tubers in the pits; and when such new tubers are planted, they will produce a healthy plant, but the old ones will not grow, either cut or uncut.

Provost Young of Castle-Douglas, discovered last season that diseased sets were pervaded and gradually devoured by a peculiar and minute insect of the worm kind, which can only be rendered plainly visible by the aid of a pocket lens. He found it in *every* diseased plant, and in some whole potatoes which had not been planted, as well as in whole ones which had been planted but did not grow. All seeds which produced healthy plants were free from the insect. Here an important question suggests itself, Is the disease the cause of the insect, or the insect the cause of the disease? I am decidedly of opinion that the former is the case, and that the insect is allured by the diseased state of the potato. Diseased subjects, both in the physical and the vegetable world, very frequently become the prey of vermin of different kinds, from which in a state of health they are entirely free. In the case in question, Mr Young found the same insect in carrots taken from an unhealthy bed, which serves to prove that it is not peculiar to the potato, but that it may be found in the decayed roots of other vegetables.

CHAPTER III.

NATURAL PROPERTIES—LAW AND ORIGIN OF THE VARIETIES—LIABILITY OF THE POTATO TO DECAY IN COMMON WITH SEVERAL OTHER PLANTS.

That the potato will be altogether lost through the influence of the present disease, as has been apprehended by some, I consider not only to be improbable, but, according to the undeviating course of nature, impossible. There is no instance upon record of any *species* of tree or plant ever having become extinct, although *varieties*, as varieties are bnt of secondary origin, and therefore changeable in their origin, will degenerate, and ultimately die of old age. In order to convince the uninitiated reader that the above assertion is neither too strong, nor ventured npon at random, it may be necessary that I give a short account of the nature of plants, as now understood and taught in the beautiful science of botany. To botanists all I am about to notice, and much more, is already fully known; bnt agriculturists in general, although much employed in the practical cultivation of plants, and therefore not ignorant of many of their properties, are yet rarely acqnainted with the beautiful processes by which nature produces them. I

shall therefore endeavour to shew, by explaining the laws of vegetable nature, how plants may decay, and what kinds are liable to decay, and how the decay in the potato may be accounted for on natural principles.

In botanical science, according to the Linnean system, all plants, from the most minute herb or moss to the loftiest tree, are arranged into twenty-four classes, with subdivisions, which are termed Orders. With these, however, I have here little to do, although the arrangement is indispensable in a scientific point of view. Plants are *naturally* divided into what are classically termed Genera and Species. The genera are the *families* into which plants are grouped. The species are the distinct and separate individuals of the several families, possessing a distinguishable difference from each other, yet preserving a close family connexion in regard to general resemblance. Some of the genera have few species; some only one; but, in by far the greater part, the species are numerous. The Erica, or heath, has no fewer than 402 discovered and named species. The Solanum, of which the potato is one, has 61. There are many species of the oak, the ash, the fir, the willow, &c., with which every one is quite familiar. That the *species* are distinct and unalterable I have said, and will show more fully by and by; but that the *varieties* which are derivable from the species, by the agency and ingenuity of man taking advantage of the provisions of nature, are changeable and ever-varying and improving, is a known and established fact.

They are, in one respect, the property of civilized man, have been given him as the reward of his industry, are improvable by him, obedient in some respects to his will, require his constant care, and will reward it whenever bestowed; but will degenerate and die, as the potato is appearing to do at present, when due attention is not paid to their preservation. That the present disease in the potato is out of the ordinary course of nature, I have no belief. It is no foreign insect, as stated by certain writers. Its first appearance along the sea-coast, and in the most fertile districts, as well as all its other peculiarities, are explainable on other and quite *natural principles.* But to proceed.

The species are the originally distinct natural kinds of plants, which shone in virgin purity on the fair face of creation when it came forth all glorious from the Creator's hand. Creative Wisdom, unlimited in all its operations, imparted to plants, in the sexual construction of their flowers, the power of self-production. While the plant is in flower, and before its seed can be produced for the continuation of the several kinds, impregnation must take place. Hence the indispensable use of the flower to every plant, it being the seat of the generative parts. What is classically termed the pistil, with the style and stigma on its top, rises in the centre of every flower, and in connection with the seed-vessel. This is the female, or conceptive part, and is surrounded by the stamina, which are the male or fructifying parts. From the anthers on their tops is emitted a fine dust, the

pollen essential to fructification, with which the stigma of every flower must be impregnated before bringing forth seed. Thus the species are continued, bnt a great deal more is obtained than this. Plants being possessed of conceptive power are capable of cross impregnation, which may be accidentally effected by the action of the air, when flowers of different species are near to each other, and in bloom at the same time; or by the agency of winged insects, moving from one flower to another, laden with the pollen from the stamina, adhering to their bodies. A mongrel or monstrous issue is the product; arising from an accidental origin, but in strict accordance with the law of nature. By this wonderful provision a variety is obtained; and when once one variety is got, many more may soon be procured; for varieties are much more ready than the original species itself, to bring forth other varieties; and thns, by selecting the best kinds only, the plant may be improved to an unknown extent. From this source have sprnng all the varieties of double-flowering plants; all improved fruits, grains, roots, and other vegetables; and the process, assisted by the agency of man, may continue to the end of time. Having thus shewn the nature of the species, that they possess the power of propagation by the natural and direct process of seeding, it is self-evident that they must continue to endure, in the soil of which they are indigenous, so long as vegetation forms an abiding law of nature. It is, otherwise, however, with varieties which are of a secondary and

ever-changing nature. Let us apply those natural principles to the potato.

It is one of those kinds of plants which, from the open salver-shaped form of the flower, are more ready to sport or run into varieties, than others of a different formation. Hence the innumerable varieties or kinds as they are called, which are now under cultivation, many generations removed from the mother species, the native plant of Peru, and infinitely superior to it in size, produce, and quality. As an instance of the superiority of improved varieties over the parent species, I shall adduce two or three plants, natives of our own country, and familiarized to every one. There is, first, the *Pyrus Malus*, or apple, a native of Britain. Look on it in its natural state, the common crab-tree of the woods, and compare it with its progeny now in cultivation, as it has been improved through the medium of varieties; or, take the *Daucus Carota*, the native carrot, which my neighbours may find in abundance on the banks of the Dee, at Tongueland Bridge, within a few miles of Kirkcudbright. Also the *Fragaria Vesca*, the wild strawberry, even as it is fostered among the "lown sunny glens" of Buittle, and compare it and the others with the improved varieties to be found in every well-managed garden or orchard; and then you may know and wonder at what has been achieved by the means which I have described, while all the time the original species of each stand distinct and unaltered, the same as they were a thousand years ago.

Having shewn the nature of the species, their

fixed and durable condition, and, on the other hand, the changeable and fickle nature of varieties, it comes next in course to shew how varieties of certain plants are liable to decay, and others not, but are durable as the mother plant itself; in other words, how some have less tendency to decay. I will enumerate a few of the leading kinds which are decayable. All improved fruits, all double, and finely striped, and otherwise varied flowers; striped-leaved trees and shrubs; roots, such as the Dahlia, the Potato; all whose kinds are improved varieties from seeds, but are continued and propagated by grafting or budding, layering, cuttings, &c., and by splitting or dividing of the roots, as in the case of the two last mentioned; all such are decayable. The reason is easily found. The variety, for obvious reasons, is thus propagated for a too great length of time. An apple, for instance, is got from seed, which possesses rare qualities. It is named from the place where it was produced, or the individual who found it, or from some peculiarity of form or colour, and soon becomes a universal favourite, and of course the demand for it becomes clamorous. The seed, however, is a tedious and uncertain source. The plant was a rare chance production of nature, and thousands may be raised from the seed of the same plant, ere a single fruit, equal in every respect, can be produced. Grafting in all woody plants is therefore had recourse to, which are cuttings of one year's growth, grafted upon the natural seed-stock, from the original species, or a variety from it. Thus the new

apple is propagated, the original individual tree is extended, or trees are repeatedly raised from trees; and the same kind is continued through centuries. With the potato the case is similar. A new kind is obtained from seed, is named, and propagated by tubers, a process analogous to grafting in trees, and differing in effect chiefly from this circumstance—a tree lasts a number of years, and bears crops successively; a potato lasts only one year, and so making a quicker progress from youth to age, it sooner falls into decay. The history and fate of both are the same; the trees only living longer, in consequence of having undergone fewer transitions than the other. Mr Knight, of Downton, in taking a view of the lists of apple-trees given by Evelyn, Parkinson, and other authors of the early part of the seventeenth century, says, that many of them are not now to be found, or they are so degenerated or diseased as no longer to deserve the attention of the planter. He mentions kinds which are in the last stage of decay. The moil, the red-streak, the golden pippin, and others, he observes, are hastening fast after them. After making a great variety of experiments for several years, and after many attempts to propagate every old variety of the apple, he observes: "I think I am justified in the conclusion, that the plants of this species, however propagated from the same parent stock, partake in some degree of the same life, and will attend the progress of that life in the habits of its youth, its maturity, and its decay." On these grounds, he accounts for the disappearance of the fine

cider apples of the seventeenth century, the original grafts of which were brought from France about the time of Charles I. Mr Knight has not condescended, in any of his writings that I have seen, (I have only seen extracts,) upon the probable duration of the *vigorous* life of the varieties of the apple and pear; but, from the long-continued varieties of some of our favourites, it cannot be less than several hundred years. There are pears yet in cultivation in this country, the origin of which can be traced back to the days of monachism. The "Abbot's Pear" is known in this district to have been taken from an old tree in Newabbey, and is still far from being of contemptible flavour; but, that all such old sorts are now fast falling into disrepute from constitutional decay, and are replaced by newly raised kinds, much to the improvement of the fruit and profit of the cultivator, is generally allowed, and goes far in confirmation of Mr Knight's argument. Having given the opinion of perhaps the most learned and judicious experimentalist in the kingdom on the decay of the apple, the nature of which in many respects so closely resembles that of the potato, I should think there can be no risk in affirming, that the varieties of the potato now generally under cultivation are similarly decaying of old age.

Green says, that they should be renewed from seed every fourteen years. John Shirref, whom London quotes, says they are a short-lived plant, and that not one that was in cultivation twenty years ago is now in existence. In this he must be wrong. They per-

haps *should not* be in existence. Dr Hunter has made a similar assertion, but without giving any detailed instances of the supposed fact. The potato, however, is *not* so very short-lived. Many of the kinds at present under general cultivation in this quarter, and, I doubt not, in other quarters, have been continued during the last thirty, forty, and even some of them fifty years. About sixty years ago there were only two kinds known in Galloway,—a blue and a white. They were both of diminutive size. The blue one was often blue to the heart. About 1780, as has been formerly mentioned, these kinds were supplanted by a new blue and a new white, and, shortly after, by several kidney-shaped sorts, all of which were superior to their predecessors. The present blue, which has resisted the taint more sturdily than any other kind has done, is, I suspect, the very individual introduced in 1780. The whites, introduced at the same period, have been rarely met with during the last twenty years; and have been followed by flat-reds, pink-eyes, and Highland earlies, which are by far the most prevalent varieties throughout Dumfriesshire and Galloway at the present day. The flat-red is supposed to have been brought into this country from Ireland about thirty years ago. How long they might have flourished in that country before transportation cannot be ascertained. Indeed, the origin of all the kinds at present in vogue is remote and uncertain. The large white earlies, commonly called Second Early, a very prolific kind, I recollect to have seen eighteen years ago. They

were reckoned a hardy kind; but, both this year and the last, they have occasionally failed. The pink-eyes and the flat-reds were, I believe, first attacked. Mr Webster, gardener at Munches, has had an early for forty years, the seed of which has never been changed. They have not failed. Many more proofs might be adduced, that the assertions of the forementioned writers are not founded on correct observation; but my readers may think, that I have already given more than a sufficient number.

One curious fact may be noticed in respect of the late varieties, which I take to be symptomatic of decay. They have ceased in a great measure to bear plums; and hence, have actually become considerably earlier than formerly. When in their vigour, these late varieties did not swell at the root until the plums had reached a considerable size. Now, having no plums, they are fully three or four weeks earlier than formerly. Such a revolution in their nature is to me a convincing proof that they have lost their vegetative vigour, and are sinking into the decay attendant on old age, merely from the carelessness or ignorance of cultivators, who have not hitherto been aware of the necessity that exists for a periodical renovation from the seed. If, then, old age be the primary cause of the disease, the remedy is plain,—bring new kinds from seed as quickly as possible. Seedlings from our present improved varieties may produce esteemed varieties which, I trust, would restore the potato to its pristine vigour. Some healthy seedlings of the second year's growth which I have seen in this quarter, give fair promise of doing so.

I have now further to shew, in proof of what I have premised, that there are other varieties of cultivated plants, which, from natural causes, are *not* liable to decay. This distinction may not be a new one, but I have never seen it stated by any writer on botany; and it is only of late that it has occurred to myself. I have seen it stated, indeed, that *all* plants are liable to decay, which I deny, considering the assertion to be contrary to the fixed laws of nature. The line of demarcation between the two orders of decayable and undecayable plants is easily traced, and ought to be traced, as the existence of the fact very naturally indicates the remedial measures necessary to be had recourse to.

The undecayable varieties are all such as are raised *directly* from seed, namely, annual, biennial, perennial, shrubby, or herbaceous plants. In this property they closely follow the law of the species, which *necessarily* renders them enduring. For clearness of illustration, I must here shortly reiterate what has been formerly stated at length, that decayable plants are furnished with two or more methods of propagation. Fruit-trees are ordinarily propagated by grafts, the gooseberry by cuttings, the strawberry by runners, and the potato by tubers. The purpose which Nature has in view in this provision is very obvious, namely, to afford a simpler, and much more expeditious method of increasing, and thereby extending, these her most valuable productions. Nature, however, whilst thus facilitating the extension of such plants by methods so summary, appears to have been at the same time perfectly conscious, that.

as they were deviations from her ordinary course, and would therefore ultimately tend to the deterioration of the varieties, it was necessary that plants should be left in possession of the ordinary generative organs, by which they could be renovated as often as the too frequent practice of the more summary methods should render renovation desirable.

On the other hand, all plants which are not decayable have only *one* method of perpetuating themselves, namely, by the seed. Among these are all the cultivated kinds of grains,—wheat, barley, oats, beans and pease; with the culinary vegetables,—turnips, carrots, cabbages, onions, and many others. Cauliflower, which is a variety of the cabbage, has been cultivated in Britain for upwards of two hundred years, and has, during all that time, continued in the full possession of its original vigour. New varieties of this and the other individuals above enumerated have been introduced, and old ones set aside. Still the preference was not given because the latter had become infected with disease or decay, but because the former possessed the superior properties of flavour, size, or productiveness.

I conclude this part of the subject by remarking, that the duplex power of propagation afforded to those varieties of plants which I have classified as decayable, not only goes a great way to *prove* that they are so, but that it is also equally demonstrative of the fact that the others are not so, seeing that they are deprived of the secondary property peculiar to the former, by the operation of which their vigour is ultimately affected.

CHAPTER IV.

PROOFS OF THE DECAY OF THE POTATO—PECULIARITIES OF DECAY ACCOUNTED FOR ON NATURAL PRINCIPLES.

I HAVE shewn, I trust satisfactorily, in the preceding parts of this treatise, that varieties of certain plants only are decayable; and that each plant of this description has a term, varying, doubtless, according to its nature, and modified also by other circumstances, beyond which it cannot *safely* be cultivated. I have also shewn that the potato is *one* of those plants, and that the varieties now in use have for the most part arrived at that term; and that, in order to be reinstated in a healthy race of this precious vegetable, it is necessary to have recourse to the primary mode of propagation, namely, re-deriving it from the seed. I shall here endeavour to place under one view several of what I consider to be evident proofs of the decayed state of the present varieties of the potato.

1*st*, The late kinds are not bearing seed as formerly. Their flowers are comparatively few, and these few generally fall off without producing plums. This proves a change in their constitution, which,

taken in connection with their frequent failure, may safely be pronounced a symptom of inherent disease.

2*d*, All the favourite late kinds have become more early by three or four weeks. This fact has been acknowledged by most persons with whom I have conversed upon the subject. The connection traced by Mr Knight between the seed and the tubers accounts fully for this.* It appears that, in consequence of potatoes ceasing to bear, seed, more nutriment is conducted to the tubers, by which they are not only forced into earlier maturity, but also increased in size, as well as rendered more farinaceous, and consequently possessing less vegetative power.

3*d*, The decay has always made its first appearance on early fertile soils, where the tubers are grown and ripened to greatest perfection, a fact in strict accordance with the laws of nature in regard to animal as well as vegetable life. Pamper any thing possessed of *any* kind of life ; and although in external appearance it may exhibit symptoms which, to superficial observers, denote a high state of health and vigour, such as increased bulk and heightened colour, it will yet, to the eye of experience, speak of nothing so much as of a constant liability to disease, —an imperfect and precarious tenure of existence.

4*th*, As a farther proof that the disease is in the potato, and not in the soil, the dung, the atmosphere, the consequence of mild seasons, nor in the mode of treatment, although it might be heightened and

* See Chap. IX.

accelerated, or even brought out by the combined effects of these particulars, we see that the coarser kinds which possess more fibre than starch have, up to this day, seldom failed. These are yet partaking largely of the qualities of the original *wild* potato. They have hitherto resisted civilization, so to speak, and have in consequence escaped the diseases incident to civilized life. They produce seed and propagate also from the tubers, and thus, "with Nature's wild vigour working at the root," will they continue to flourish a much longer period, until by high cultivation their fibrous part is diminished and their starch increased so as to bring them into a state exactly similar to that of their pampered aristocratic kindred. On this principle alone is the durability of one kind over another founded; in the proportion the component parts of the root bear to each other, on such does its constitutional health depend, and its life is accordingly lengthened or shortened.

5*th*, All kinds of plants of a similar nature to the potato, shew more vigour in stems, flowers, and fruits when newly brought from seed than at any after period of their future life. Fruits are more juicy and weigh heavier; flowers of tuberous roots, such as the dahlia and ranunculus, display more general health in stems, leaves, and petals, and the potato is possessed of more sap in its tubers. That they all progressively recede from this plump state, is quite evident to every cultivator. The fruits by losing their juices become less valuable, but the case is different with the potato; the drier and mealier they become

they are the better for food, but lose their youthful powers of vegetation. This process being progressive, however retarded or accelerated by different modes of treatment, soil, or situation, a period must arrive when existing fruits will be so juiceless as to be unfit for use; and potatoes so dry that they will no longer be capable of vegetation. They thus exhibit evident proofs of decay, were it even a matter of doubt that all things possessed of either animal or vegetable life were not subject to death. Propagation by any other way than from the seed, does not produce new plants. It is here where the mistake must rest with those who defend the durability of the potato; they most erroneously consider that rearing a plant from the cutting, or any other similar way, is synonymous to raising it from the seed. It is not so, the plant i not renewed; a new and succeeding generation capable of going through all the gradations of life is not produced.

Many capricious phenomena which have been recorded of the potato may be accounted for by the above observations. Have the potatoes planted in the morning, or at any time when the air was cool and the ground damp, grown?—it was because the earth and atmosphere were in a state less likely to draw upon their diminished juices. Have they refused to grow when planted at mid-day, or at any time during very dry weather, or when the soil was very dry?—an opposite state of the earth and atmosphere was obviously the canse. Have they failed when planted on dry manure, or when placed *above*

the manure, and succeeded when planted *above* damp well-rotten manure or beneath any kind of manure? To these questions, one answer and one reason will suffice: the varied phenomena depend upon the exhausted state of the potato, as affected by the varied state of the dung, the earth, and the atmosphere. Have they refused to grow when cut, and succeeded when planted uncut?—the reason is quite plain, that when the skin is unbroken the juices of the potato are defended from the influence of the air or soil, and the tuber must be stronger in an entire than in a divided capacity. Have the failures been at times partial, that is about one-half or one-third part failing, while the other part grew?—the cause of this is in the different degrees of strength that the cuts possess, those from the top end growing when the opposite end failed; for there is a great difference in the consistency of the two ends; the top being the most sappy, the cuts from it form the most active seed. It thus appears that the potato must be in a most precarious state, when a trivial change in the state of the air or soil has a fatal effect upon it. The effect appeared most unaccountable at first, and would do so at all times, unless when considered in connexion with the theory of inherent decay in the root, either from the age or constitutional weakness of the kind failing. When any kind of potato is young and juicy, it will resist every kind of rough usage, and which all kinds long and successfully did. But when their state changes, by the wearing ont of the juices from the effects of having undergone a long succession of plantings, or having been pam-

pered on rich soils, more tender treatment is requisite, the nature of the plant requires to be studied, and judicious assistance afforded it by the skill of the cultivator. But assuredly this judicious assistance has not been given in the unnatural and artificial manner generally adopted in preserving them during winter. Nothing can be more hurtful than premature growth previous to planting, and that evil has never been guarded against. It is perhaps the worst usage of any the potato can be subjected to. Whenever the tubers approach to an aged state they become less juicy, and what little juice they have to spare, is by the winter usage destroyed. They are rendered unable for vegetation, and reduced to a state so precarious as to be under the control of the most triflingly favourable or unfavourable circumstance.

It may here be inquired, why the decay of the potato has become so general of late years over the kingdom. The theory of the kinds being worn out by age, does not, it is admitted, *fully* support what has happened; although decay, it may be granted, on the other hand, has at one time overtaken a greater number of varieties, and spread over a greater extent of country than could reasonably have been expected. These apparent difficulties do not overturn the theory of decay; but the hastened and general occurrence of decay may be the result of some strong secondary cause, which I think is to be found in the altered state of the seasons, in the almost total absence of frost for the last five or six years. Not that I consider frost to be of any use to the potato, but its absence for a

series of years may have encouraged or permitted fermentation and premature growth in the pits, by which the tubers have been yearly weakened, and the general calamity become national; the whole country being under similar circumstances in regard to frost. I consider the present disease in the potato, to be much the same as the curl formerly was, but by a concurrence of some strong secondary cause, which perhaps did not exist at the time of the curl, it is rendered more fatal. That the absence of frost is that cause, is the most feasible conjecture I can form on the subject. Did the curl only prevail in mild seasons?—is a question, the answer to which in the affirmative would establish the analogy of both diseases.

An important inquiry here presents itself; can any thing be done to prevent so serious an evil? I answer, the nature of the decay being once understood, the remedy is obvious. It appears, from what we have already seen, that certain treatment either accelerates or retards the decay of plants. The potato is not yet in the last stage of decay; and the progress of decay may be retarded. How to accomplish so desirable an object, I shall proceed to point out in the three following parts of this work. I am convinced that the accomplishment is quite attainable on natural principles.

CHAPTER V.

AUTUMN TREATMENT OF SEED POTATOES, AND WINTER PRESERVATION.

As the raising of new kinds of potatoes from seed, is a process which requires years to accomplish, it will be necessary to inquire what can be done in the way of preserving the old ones, until a sufficient quantity of seedlings be in readiness to supply their place. It has been observed that the taint first shewed itself on early and fertile soils, where the tuber being highly farinaceous, and more perfectly matured, or, in other words, becoming less sappy, was conseqnently less prone to vegetation. In such situations, during the prevalence of curl, seed brought from moorland districts, where it never attains to a highly farinaceous state, was found to be efficacious. But as seed could not thus be obtained in sufficient quantities, farmers had recourse to the most promising snbstitute. They planted their own potatoes in a half-ripened state, and this practice was found to answer nearly the same purpose as *inbrought* seed; and this practice I would most strenuously recommend at the present crisis.

I shall take the liberty of giving a few directions on this head, which may not be useless to those who have not had experience of their own.

In the first place, I would say, take up your seed while the skin will easily rub off in handling, and before the stalks begin to lose the dark-green colour. Separate from them any very large ones, because these being the ripest, as well as most porous, will be more easily acted upon by atmospheric and other influences, and consequently in greater danger of becoming diseased. I would also recommend setting aside the *very* small ones, for although they may be *sure* enough seed, they generally produce puny stalks, and scanty produce. I consider that a potato when it reaches the size of a pigeon's egg, is, as seed, equal to a common-sized cut; much smaller, they ought not to be used. I am sensible that common opinion is in favour of small potatoes for seed; and, when they are selected from a bulk which has been fully ripened, common opinion is right. But it is not on account of its smallness that it is preferable, but because it is *greener* than the general bulk, having been of later formation, and therefore more sappy and proner to vegetation. I would recommend the use of green seed raised upon a farmer's own lands, in preference to that brought from high and cold districts, for no other reason than that it affords him an opportunity of retaining any favourite kinds, which, were he to lose, he might find difficulty in replacing. There is little danger of taking up *too* green. Even if only two-thirds grown, they will keep perfectly well when

properly secured. I have proved this in the month of June, from such of my early kinds as were left in the ground when the rest were removed. These having remained in the ground all the season round till spring, when they produced much more vigorous and healthy shoots than such as were fully ripened. They are also much earlier in springing, which indicates superior strength. Spreading out the seed potatoes, and allowing them to lie above ground, exposed to the weather for two or three weeks, until they become quite green in the skin, is no new practice. It is generally and extensively practised by market gardeners and farmers, in the neighbourhood of large towns. It is considered that seed, so treated, produces healthier and earlier plants. They can only do so from their possessing more sap. Upon the same principle, the crab, as it is regularly called, or small green excrescence, which sometimes appears on the stalk above ground, are found to be good seed, although never larger than a full grown potato plum. I had an opportunity of observing an instance of this last season. A furrow of them was planted in a garden alongside of others, from ordinary cut seed. The plants from them were much more vigorous than from the others; remained much longer green, and produced plums, while the rest were without. I consider this as a most decided proof of the advantage of green seed, and also of exposing the seed to be *greened* by the weather. They are both, I am convinced, but of temporary benefit. Such means cannot impart to the tubers full vigour, and still less the

longevity that is acquired from a renewal of the variety from seed. It will only be efficacious for a year or two. But even this much gained, in the present state and prospect of the potato, is a triumph. When the seed is separated from the ground, great care must be taken to preserve the sap and prevent exhaustion; green tubers being more precarious to preserve than those that have been fully ripened. The earth, however, will preserve them fresh and sound. Not one is known to rot when left in the ground. No matter at what time they are parted from the parent stalk; they all spring vigorously when the natural season arrives, and not until then. This fact suggests, then, the plan to be adopted. The nearest approach that in pitting you make to their natural bed, the greater the certainty of preservation. Keeping this injunction in view, I recommend the following plan:—

Prepare a pit in a situation free from the possibility of retaining bottom water. Sink it a foot deep, if the soil will admit. The width may be from three to four feet. Spread a layer of potatoes along the bottom not deeper than four or five inches. Then throw over them a stratum of the dry well-broken mould, taken from the pit. Then lay another layer of potatoes of the same depth, and more earth, as formerly. Add a third layer of potatoes, and finish with a gently rounded, not a ridged top, as usual; and, still retaining the rounded shape, cover eight inches of earth over the whole. Cut a trench along both sides of the pit to carry off water. Be sure to have loose earth nearest the potatoes, and allow as

much of it as possible to mingle with them. Take care that they be dry when so stored, and that there be no *wet* earth adhering to them, as potatoes laid past in a wet state never keep well. Use no straw on the top, as I wish the earth above the potatoes to know the changes of weather,—to receive damp or drought alternately, in order that, as near as possible, their bed may resemble that in which they grew. I hope my object in the above specified plan will be discernible by every person. Under the ordinary pit or house method of preserving, potatoes begin to grow very early in spring, and when once growth has fairly commenced, they become hot in the close body that is formed by the daily increasing fibres; the growth is more hastened, the heat by becoming more confined by the thick mat of straw, which lies betwixt them and the top earth; which earth would otherwise in a great measure extract the internal heat, were any such engendered.

When the potatoes are taken out of such pits, or from large masses in close houses, to be used for seed, the growths are generally picked off (*chunned,*) which process very much exhausts the vegetative sap of the tuber, and renders it unfit for seed. A third or fourth part of its whole bulk, and that the most essential for the purposes of vegetation, is destroyed. To those who may not have paid more than usual attention to the selection and preservation of their seed, I would suggest the following alternative:—In the last season, there was in almost every field more or less of second planting; and a number of fields were cut down by

early frosts while the stalks were quite green. The produce of neither of these could have had time to be over-ripened; and therefore may be used for seed with considerable chance of success, or a change may be procured from a cold late soil. These should be taken from the pits early in spring to prevent premature growth, and spread in an open house, and frequently turned over.

The winter preservation of the potato for *food* is also a matter of considerable importance. Here the treatment I would recommend varies from the other. In the first place, allow the crop to be fully ripened, and matured in the ground, before taking it up. A reason for this will not be wanted, when it is evident well ripened tubers alone constitute wholesome human food. Taking them up in dry weather, has a very considerable influence on the quality of the tuber. If the weather, however, should prove unfavourable, they ought not to be put up to remain, but ought to be placed in temporary heaps, and covered with straw, and afterwards, when the weather clears up, spread out until they become dry. In the second place, the time at which they are designed to be used ought to be kept in view. Those intended for immediate use may be advantageously stowed into dry and airy houses. Such as are to be used in winter ought to be put into close houses, or pits well covered with straw; the latter to have a sufficient quantity of dry earth to resist frost. In neither houses nor pits have them in very deep masses. I recommend straw upon the pits only on this account:—

when they require to be opened before the middle of February, they are, when so covered, dryer, and less uncomfortable to persons handling them. Beyond this date they ought not on any account to be allowed to remain in such pits, as they would very soon be injured by early growth. Such as are intended for spring use, require to be put into pits of the following description:—Dig them to the depth of the soil, not more than three feet wide, lay in the potatoes, and pile them up with a ridged top, in the usual form, then cover them well with earth, laying loose mould nearest to them. Beat the earth well with the spade, lay a ridge of straw along the top, in case of any fissures or openings taking place, into which rain or frost might otherwise make its way. Such pits are of all others the best fitted for keeping potatoes for spring use. In such narrow pits they will not take any heat, the earth above and partly amongst them entirely preventing it. When needed, take them up in dry weather, and the earth will easily be separated from the potatoes. So managed, they will generally keep without being injured by growth, till the middle of April, when they should be taken out and spread thin on a dry floor, in an open house, where, by frequent turning, they will remain in a good state of preservation until the new crop be fit for use. In the last place, when potatoes have been injured by frost, or taken from wet ground, secure them in narrow pits, mixed with abundance of dry earth, build them up to a ridged top, and cover them

up in the manner last described. The earth will prevent the injury from extending itself. Thus, by studying the time when they are required for use, and the state they are in when about to be stored, and by varying the mode of preservation accordingly, the potatoes may be kept in a much higher state of preservation than they are in general to be met with at any season of the year.

CHAPTER VI.

SPRING TREATMENT OF THE SEED.—PREPARATION BEDS.—TESTING OF THE SEED AND TRANSPLANTING.

I now come to an important stage in the process of spring treatment, namely, the testing of the seed by preparation beds. Of this I have had personal experience sufficient to convince me of its manifold advantages, and I hope that, by the time the reader has glanced over the few following observations, the advantages will be so apparent as to leave as little doubt upon *his* mind in regard to the matter, as there is on my own.

Several writers of essays and others, from the failures of last season being very much extended by the drought of the month of May, are now recommending early planting in the ensuing spring. But what would be the advantage should a still earlier drought set in, or should a bad winter and spring prevent the ground from being prepared in time for early planting? There has been much difference of opinion in regard to the merits of early and late planting. They have both advantages and disadvantages. My plan aims at combining the advan-

tages of both. In May, which may be considered by many as late, under the present circumstances, the ground can be more effectually cleaned of root-weeds, and better pulverised; but April has also its advantages, the crop, being sooner ripe, is of better quality, and in less danger of being injured from early autumn frosts. But to proceed.

The potatoes having been selected, and secured in earthen pits, as formerly directed, they should, in March, be examined, and if appearing to spring, taken out of the pits and spread on a dry floor, where they may remain until the time of cutting, which should be early in April, taking care to prevent premature growth by the means formerly pointed out. Having attended to the foregoing directions, I would now say, begin the operation of preparing the sets. Select a piece of dry ground, in a securely fenced place; when required on a large scale, as will be the case on extensive farms, lay the ground off in beds of five feet wide, with alleys of two feet. Use a garden line, and lay them off in a neat manner. From the alleys take earth to cover the surface of the beds, taking care to raise them a little in the middle. This done, have in readiness, and placed conveniently to the beds, a quantity of fine compost earth, consisting of one-third of moss, one-third of clean earth, one-third of peat or coal ashes, mingled with a small proportion of lime, enriched by urine, or pourings from a dunghil. The beds and compost being both in readiness, cut all the seed potatoes which are above the size of a common hen's egg. By

the first cut, take off about the fourth part at the root end, and lay it aside for food. Next, divide the top end into pretty large cuts, the small ones use entire, either kept by themselves, or mixed with the cuts. When a quantity is thus cut, spread it over the bed, upon which previously is to be laid a thin covering of the compost. I would recommend the layer of potatoes not to consist of more than *two* cuts in depth, spread over with an inch of compost. This done, if the weather be dry, take a watering pan and water most effectually, in order to wash the compost into the bed amongst the cuts; the quantity of water being regulated by the state of the weather. After this, give them another covering of compost, in all about three inches in depth. In this manner proceed until as many are so laid down as will be required for the farm. Farther watering will only be necessary if the weather is dry. After the cuttings have lain in the seed-beds some time, it will be necessary to examine them to see if they are springing, of which there can be little doubt. If *any* doubts are entertained, however, it will be necessary to prepare more sets, and put them in fresh beds, to insure a sufficiency at the time of transplanting. The chance of the seed springing in the beds is ten to one, compared with the ordinary way. Here, should the weather be dry, abundance of moisture can be communicated at any time; and in place of a parched soil robbing the sets of moisture, till they are quite shrivelled, as was the case during the intense drought of last May, the sets will be duly fed and nourished from the fat juices of

the rich compost. Allow them to remain in the bed till the shoots come above ground. If the compost has been mixed with lime, as directed, it will act as a powerful stimulant upon the weakened and exhausted vegetative powers of the potato, and very much accelerate and strengthen the young shoots. If this has been neglected, it may still be partially accomplished, either by dusting powdered lime among the cuts, or mixing it in the water. If no compost has been prepared, good clean loose earth will answer the purpose, but it would not be equal in efficacy to a rich well-prepared compost.

The next thing to be attended to is the field operation. All potato fields should be cross-ploughed during dry weather iu spring, well harrowed, then drilled, the whole field at once, or a part, as may be most convenient. Then lay in the dung, and cover it in the usual manner, till the whole is finished; and for more effectually destroying root-weeds, and preserving the soil in a loose state, take the driest weather that can be got for the operation. As the sets are not put into the ground along with the dung, the driest weather that the season affords may with safety be taken advantage of. At this time the drills may be either harrowed lightly or rolled, the nature of the soil and the state of the weather determining which. If the weather is very dry and the soil rough, a good rolling will bruise the lumps and press down the dung in the drill, both of which will be of advantage in the after operations. This would be the best time to cart off all weeds and stones, if such are on the

ground. Then plough up the drills in the usual manner, laying all the earth to them that can be conveniently lifted. Give the drills such harrowing as will bring the dung to within a few inches of the surface. The field being now ready for transplanting, choose mild weather. If there has been rain between the laying in of the dung and the last ploughing, the soil and manure will be incorporated, and in a properly cool state to receive the plants. But if there have fallen no rain, and the ground and dung be very dry, the transplanting should be deferred until after rain has taken place. Any time from the 15th May till the 1st June, will suit for transplanting. The sets should be carefully turned out with a potato graip, lifted carefully with the hand, the loose earth shaken off, laid into a cart, and taken to the field. The same morning, a plough should commence and run up the centre of each drill, fully as deep as the dung: I would prefer a small quantity of the dung being turned up rather than not have the furrow deep enough. This operation will allow the dung and the soil to intermingle, which I consider to be an advantage. By such intermixture of the dung and soil, the plants will find a very suitable bed for their roots, and will immediately begin to grow. The plants being laid down, immediately proceed to setting; place the sets against the most perpendicular side of the plough furrow, at the distance of eight inches asunder. Following every two or three planters, let a person, with a hoe, similar to a turnip-hoe, draw a sufficient quantity of earth to the plants, taking care not to smother the tops. If

the plants have not come above ground in the beds, they may be slightly covered to the depth of about an inch. On certain free soils the plough may be used in place of the hoe to cover in the plants. A few people will go over a large quantity of ground in a day ; for an extensive farm, say nine layers and three coverers, two people to take the plants to the field, and lay them conveniently down, with the ploughman and a skilful overseer, sixteen in all, will be sufficient. The above number of labourers would, in five or six days, finish the whole work of transplanting.

The extra trouble of this method would not be so great as may at first sight be supposed. During the time of putting in the dung, no delay would then be occasioned on account of planting. All hands could be turned to that particular part of the work, and could proceed with safety during any state of the weather ; the field being all finished by ploughing, harrowing, and cleaning, during the most suitable weather in May. By this method there can be no dread of losing the crop ; for the plants being put into the ground, well rooted, they will soon catch the dung and be capable of supporting themselves.

The potato, of all the plants I am acquainted with, is the best adapted for transplanting. It abounds with fibrous roots ; the main shoot is of a *fleshy* nature, and most tenacious of life. The parent tubers adhering, furnish nourishment to the plant during the operation. Thus supported, from its peculiar resources, it will exist above ground without perishing during several days of the hottest summer weather.

As a proof that the potato will succed well when treated in this way, a farmer in Galloway had a very good crop on about two acres of his field, which were planted during the driest period of last spring; he had laid past in a pit in autumn, a quantity of small potatoes, the refuse of a lot he had sold. When the weather became very dry in May, and he began to suspect his cut seed would fail, he opened this said pit and found the potatoes all sprung to the length of two or three inches. As an experiment, he had them carefully planted with the shoots on them on the top of the dung, and covered in with the plongh in the usual way. The result was, that they proved a good crop, when the rest in the field were very inferior. When he secured a crop by such iudifferent management, may not a superior crop be expected when a better system of management is adopted?

By pursuing the above plan, confidence in the crop will be restored. The ground being recently wrought, a plentiful crop may be relied on, and the advantages of both early and late planting are combined. At the proper season have the earth pared off; and the spaces betwixt the plants hand-hoed if necessary. Pass the drill-harrow along once or twice to pulverize the earth; and at the proper time again plough it *to*, and be sure to give the drills a sufficient quantity of earth. This plan will be found quite applicable either to cotters or farmers, and will suit alike in field or in garden. In cases where a farmer has a weedy field, or is behind with his labour, this plan allows ample time to accomplish the effectual cleaning of the ground,

without the crop sustaining damage from being too late. If the sets are put into the beds in April, they will still be progressing, while the other operations are going on. An additional advantage will also be gained, as cut sets may still be used with perfect success; and several cultivators are of opinion that cut sets produce the most abundant and equally sized crop. That this plan may meet with objections in consequence of its not being yet founded on an induction of extended facts there is every reason to expect; but that it will answer the purpose of securing a crop, I have not a remaining doubt. I have practised it myself on a small scale for three years, and am determined to follow it out. The complete success with which it has been attended in my own case emboldens me to recommend it to others on a more extended scale, as an effectual preventive of the decay.

CHAPTER VII.

SPRING TREATMENT CONTINUED—WHOLE SEED.

It may still be inquired, Is there not another more plain and simple method of preventing decay, and by careful treatment preserving the old kinds in cultivation for a few years, until an abundant supply of a new and healthy breed is obtained? I answer, that there *is* another, and that it is not a new one. It was the original method before any other was discovered. It has all along been the prevailing method in certain quarters, and appears to be the favourite plan of Green. It is also given in Loudon's late work, the Encyclopædia of Agriculture. It is the favourite practice in Cornwall, and different districts in the south of England. It has been lately recommended, and very generally adopted, as a preventive of decay, with what was at first considered universal success, but has in several recent cases been found deficient, and cannot, therefore, be recommended as an infallible cure. It is planting the potato entire. As a temporary remedy it has certainly been not without use; and when the nature of the decay is un-

derstood, and the requisite precautions taken to preserve the seed in a juicy and healthy state, I have no doubt of its continuing to he of use.

I shall shew how, in accordance with my theory, it may be successfully practised. But before entering on explanation, I have a few considerations to urge as to the propriety of cut seed upon economical principles. That the potatoes are furnished with a number of eyes, each of which is possessed of a germ, capable of producing a plant, has long been known to the world and very generally taken advantage of. That such an ample provision for the abundant annual reproduction of the plant should be laid aside, must argue a deficiency in our knowledge of its capahilities. The using of whole seed can only be excused on the principle of expediency.

There is an objection used against whole tubers as seed, which I may here refute, namely, that they produce too great a number of stalks from different eyes. This is not the case. When the potato has been properly treated, its first effort is to produce a strong healthy shoot from the top bud. All the others yield to its right of superiority, and very rarely more than one comes forward. If, however, the tubers allowed by improper treatment to produce premature growths, and if before planting these are taken off, *then* if the potato is possessed of remaining strength, a rivalry in the other huds is the consequence. But whose fault is this? The cultivator's most assuredly.

I would recommend using only moderately-sized tubers, which should be carefully selected. A small

whole potato is an excellent substitute for a cut. The skin not being broken it will resist the drought much better. Let the seed be chosen from early raised unripe tubers, and kept tbrough winter, as also formerly directed; the spring treatment being in every respect tbe same as that prescribed for the cut seed, with only one exception, namely, that I do not consider it to be necessary to test them in the preparation beds. But there is one precaution to be used witb the whole seed which will be highly beneficial. Twenty-four hours before planting have it steeped in water, or in an infusion of lime and water. If barrels and tubs cannot be obtained, lay the tubers on a floor, about eighteen inches deep, in the form of a malt heap, and water them with the forementioned liquid for four or five days, once each day. This will fill the tubers with a sufficiency of water and thereby encourage vegetation. And should the ground be very dry at the time of planting, snch watering will give them the power of resisting its effects. As dryness in the tubers appears to be the chief cause of the decay, pay particnlar attention to having them in a sappy and growing state before they are pnt into the ground. If allowed to remain in tbe growing beap until each tuber had prodnced a shoot of one inch in length, I would consider it a safe precaution, because in that case all tubers wbich had not produced healtby sboots could be rejected, and the drills only planted with sucb as conld be depended upon, and uncertainty in the success of tbe crop would be avoided I consider there is very little danger of a

moderate sized entire potato not growing, provided, first, it has been taken up in a green juicy state in autumn : Secondly, preserved in that state during winter : Thirdly, planted with its first shoots entire and in a growing active state, to aid which watering is necessary: And fourthly, put into the ground when both the soil and dung are in a proper cool state. These are the main points to be attended to.

I would recommend the soil to be treated as formerly. Cross-plough, and harrow well, drill the soil, lay in the dung, cover in, and allow it to lie a week or two in this state. At a suitable time, after a half or a third part of the field is dunged and covered in, roll or harrow, which of the two it may require, and split the drills, and plant the seed at the distance of one foot asunder, which I consider a good distance for pretty large seed. When the seed, however, is not larger than ordinarily sized cuts, I would place them at the same distance as that apportioned to cuts, namely, eight inches, bnt to obtain this it will be proper to size the seed in the conrse of preparation. Plough in the seed with a good deep furrow ; allow them to remain so for some time, and then harrow them to bring the cover to a proper depth above the sets. In this manner proceed at two or three intervals.

It will be here seen, as in the former case, that I recommend putting in the dung, and covering it some time previous to planting. I have several reasons for this. The first is, that when the dung is pnt into the earth and mixed with it, as will be the case from rolling and harrowing, the earth will be in

a cool and prepared state for the reception of the seed. If the dung has been put in a dry and hot state, and if rain has fallen, it will be dampedand cooled. Or, should no rain have fallen, the natural damp of the soil will effect this to a certain degree. Or, should the dung have been put in wet the soil will have absorbed the superabundant moisture. Or, should a period of dry weather, with an east wind, set in, such is a very improper time to expose the seed ; but the best time to get on with the other field operations.

Another reason is this : By not putting in the seed with the dung the drills will admit of a process of rolling and harrowing, to bruise lumps and destroy weeds, and incorporate the soil with the dung, in a manner that is not attainable under the old process, but which is of greater advantage than cultivators are generally aware of. A very intelligent farmer in Galloway has prepared a very considerable part of his potato field the last autumn, drilled it, and has been laying in the dung during winter, and ploughing it into the ground in the usual way. He means to put the dung all in first, then in favourable weather in spring, harrow and plough up the drills, and finally, split them, and put in the seed in the manner I have described. I have seen many instances of crops lost by the old plan, and the ground, in place of being cleaned by a potato crop, actually made worse. By this plan there is little extra work, the seed being set after the first ploughing ; no extra ploughings being required more than is usual, only the splitting of the drills for the

seed, which is a simple process. To finish the operations in a proper style, and to insure a good crop, have the drills pared off in good time, before the plants are large. Hoe them well with hand-hoes. Three-pronged hoes, in the form of a drag, which is used in every farm for drawing dung out of a cart, would be the preferable instrument. They should be made small and handy, with prongs about four inches and a half in length. With these, hoe between every plant, the distance betwixt the plants being such as will admit of the hoes being freely used. Take out every weed, and draw out from betwixt each plant a portion of the hard stiff earth. Pass the drill-harrow once or twice along the furrow, to pulverize the soil, and hand-gather the root-weeds turned out by the harrow. Then plough a furrow to each side of the drill, and the whole summer work is finished. To conclude, if proper care has been bestowed on the few essential points I have endeavoured to describe and enforce, the danger of failure is not much to be dreaded. I have thus finished my directions, and given my reasons for what I have suggested, which cannot fail to be understood, and which I trust will be appreciated and acted upon for his own sake by the discerning and intelligent agriculturist.

CHAPTER VIII.

RAISING OF EARLY POTATOES IN FIELDS.

As I have formerly observed, in an early part of this work, potatoes, from the variety of kinds into which they have now run, comprising lates and earlies of various degrees, in place of being an article of the season, as formerly, their use can now with ease be extended for food, for both man and beast, the whole year round. But that such high capability of the potato is but imperfectly taken advantage of by farmers, is but too evident, and must proceed from their ignorance of the proper method of raising early kinds, for summer use, in the fields. They give them in every respect similar treatment with the late kinds, except it may be in planting them a little earlier. But, the early kinds differing materially from the late, being more tender, require a different mode of treatment, but which is seldom afforded, and rarely ever succeeds in raising a plentiful crop.

Owing to the state the potatoes have now got into, they are not so capable of long keeping as formerly. I consider it therefore both troublesome and unprofitable to attempt keeping them beyond the end

of June, or any longer than new ones can be got, which on early soils may be sooner. In using new potatoes there is no waste, which is not the case with old ones. The green-stalks of the new crop will be greedily eaten by pigs in summer, and are better food for them than old ill-kept tubers.

That such capability of the potato may be turned to advantage, I shall here give a few instructions, such as I consider necessary for raising plentiful crops of early kinds; and shew wherein they differ from the late kinds, and require peculiar treatment. When the treatment is properly understood by farmers, it will give them the advantage of an abundant supply for domestic purposes, besides enabling them at an earlier season to bring a supply to an adjacent market. To proceed, in pointing out the peculiarities of the earlies; I have, first, to observe that all the kinds are more or less dwarfish in their manner of growth, particularly the *very* early kinds; which are so much so, as to unfit them for field cultivation. They require more tender treatment. For fields, I would prefer a second or third early, or some more robust kind, various of which may be got, and several of which produce large tubers, and are still comparatively early. The treatment they require, different from the late kinds, is simply this:—Give them a free, light, sandy, or dry mossy soil, and use well rotten dung. The reason for this state of the dung is obvious, the crop being so short time in the ground that, unless it is well prepared, they can derive little benefit from it. Light covering is also necessary, and less space betwixt the drills, as also betwixt the

plants in the drills. If deeply covered, they are retarded in getting up, and the stalks thereby weakened. If thin planted they will grow too large, not ripen so soon, nor be of so good quality when ripened. I would therefore say, in planting early potatoes in fields, work the soil well in dry weather in March. Make the drills about two feet wide, give a moderate quantity of dung, plough it in, and allow it to remain eight or ten days; then harrow the drills in dry weather, and split them lightly up the centre as before described; running rather above the dung than into it. Then cut and lay in the seed, at five inches distance, and cover lightly. When the plants are a few inches up, pare off, and weed and hand-hoe. Plough up very soon, with a gentle furrow, as I do not approve of covering early potatoes deep at any season. The first and second week of April, I consider a good time for planting. Very early planting is of little use; for until the seed receives the natural heat of the earth, it will not spring. The seed of early potatoes may be cut, or at least the large ones, using the small ones whole in separate drills from the cut ones. The steeping of the seed in lime water, as before directed, I would consider as a safe precaution. Here green tubers ought also to be used, as they are not only a guard against decay, but also materially expedite the growth of the plants. Means might be used to force them still farther forward, by laying the cuts upon a bed of warm horse-dung, and covering them slightly with earth or compost, and allowing them to remain there for ten days or so.

CHAPTER IX.

RENOVATION OF THE POTATO, BY RAISING NEW KINDS FROM SEED—BEST METHOD OF DOING SO.

I HAVE shewn that the decay of the potato, with all its attendant peculiarities, is only the neces sary result of natural causes, and nothing more than will overtake every variety of plant, either root or fruit, whose continuance is prolonged otherwise than from seed. To be aware of this peculiar tendency, however, is to become possessed of a knowledge of the means of its prevention. If the disease proceed from propagating exclusively from the root, it follows that the cure must be found in returning to nature's primary process, namely, propagating the plant from the seed. On this principle, my theory has all along proceeded; the objections to it being principally the following:—First, That it is of no use to raise the potato from the seed, because in some instances it has already proved ineffectual; and that there is no method by which it can be successfully renovated, except that of bringing it once more directly from the soil of which it is indigenous. I con-

sider this to be, in the present state of matters, a dangerous assertion. If people are taught to believe that we will be forced to have recourse to the wilds of America in order to preserve the potato in existence amongst us, an end is at once put to all future exertion in respect to every other method, and the potato *must* leave us as a matter of course. Let it only be fairly considered, and it will be seen that, even although the supply of this *wild* seed could be procured in abundance, of which we have no surety, many years must elapse ere Europe—the world—could again be in the enjoyment of this indispensable requisite of human food. This being the case, it is wrong in any individual to broach such opinions, so long as any method affording the remotest hope of success has been left untried. It ought to be the aim of every writer on the subject, instead of paralyzing the country's exertions by such doleful insinuations, to inspire them with hope, and by a constant discussion of all feasible remedies urge them so onward, that every thing may be attempted within the reach of human ingennity to avert the plague. For my own part, as will appear obvious from what I have already written, I am not one of those who despair. I believe the cure to lie many thousand leagues nearer home than Chili and Peru; and that seed may be selected through the aid of science, combined with experience, from the varieties at present in use, by which the root may be speedily reinstated in all its primitive excellencies. I proceed with what I conceive to be the necessary pre-

cautions to be used in the course of raising potatoes from seed. All kinds of fruits, and all roots resembling the potato, are naturally capable of a wider range of variation than other plants. There are variations in colour, shape, size, taste, late or early properties, and, what is common with every thing else, constitutional vigour; hence the necessity of selection. Amongst a very great number, only a few may be found possessed of qualities which warrant their adoption. While introducing new varieties, a constant and scrutinizing selection is necessary; for while there is in such plants a power and an inclination in certain individuals to advance, there is a contrary tendency in by far the greater part to retrograde to the rudeness of the original species. If multiplication of varieties is the object in view, take seed from a field where a number of kinds are flowering in mixture. In such a case, it is impossible to prevent cross impregnation. If seedlings of any *one* favourite kind are wanted, take a tuber and plant it entire in a secluded spot, so as to prevent admixture with the pollen of other varieties. The covering of the plant with a hand-glass, while in flower, will be of advantage, as effectually excluding it from intercourse with insects. This is the most probable method of gaining the object desired.

If a hybrid is wanted betwixt any two kinds, plant them close beside each other and treat them in a similar way, and their progeny will partake of the properties of both. Hybridizing several healthy kinds is not an unlikely way of obtaining what is

desired, an improved and healthy seedling. This last, although the most plain and simple, is not the most effectual method of hybridizing plants. When it is desired to hybridize any two plants, suppose two kinds of the potato, nature may be assisted by the agency of man, and be led to accomplish the object. To a certainty the operation requires attention; and though simple, nicety of execution. Plant any one of the two kinds to be hybridized in a secluded spot, which may be termed the mother plant; the male may grow any where, either distant or near. Then observe pointedly the morning when a head of blossoms are about to expand on the mother plant, and as soon as the flower petals are opened and the stamens and pistil are developed, cut away very nicely, with fine pointed scissars, the stamens from every flower, and when the sun has fully expanded the newly opened blossoms on the male parent, cut off a quantity of them and dust their pollen or farina over the flowers artificially rendered solely female on the mother plant. The impregnation of the stigma of such flowers with the farina of the other kind by this means, forms a complete union of the properties of the two in the progeny; by this process, also, late and early kinds may be blended, or early kinds brought from a late mother; or the process may be reversed and late kinds brought from an early mother, the progeny will become so, and possess to a great extent the qualities of the parent from which the farina was taken. Thus may fruits, roots, and flowers be changed, improved, and varied to an endless infinity.

A question here presents itself: As the lately raised kinds are said to be more tender and short-lived than some of the old kinds, may it not be possible to push them into too high a refined state? If this danger exist, it can easily be rectified by hybridizing the improved varieties with the wild species. This hybridization would cause them to retrograde in quality a few degrees, but would certainly increase, or rather restore, their natural vigour of growth; but this danger is only supposititious, and unprecedented. No other variety of fruit have become so decayed as to render such a process necessary. Improved apples and pears have all along been procured from improved kinds, and it has never been found necessary to return to the wild species. The wild potato, I consider, is as inferior in point of size and other qualities to the present improved kinds, as the crab of the woods is to our best apples. To return to either would be losing much of what we have already gained. I would much rather advise to proceed onward, and select well. If one really good kind could he obtained from hundreds, it is enough to propagate from, and exclude all inferior kinds. Much mischief has already been done by keeping too many promiscuous kinds, not the least of which is the evil report brought upon the potato, one of Nature's most bountiful and rich provisions.

But in order to procure healthy seedlings of any kind, the seed must be taken from vigorous plants. The surest indication of vigour is a numerous and large-sized crop of plums. Let seed then be taken from

plants alone which bear plums. But as it is difficult to find plants of this description, in the present decayed state of the potato, the mode of forcing them to bear seed, as practised by Mr Knight on some of the early kinds, ought to be adopted by cultivators. He was led to suspect that the absence of seed in the early varieties, was caused by the early formation of the tubers, which drew off for their support that portion of the sap which, in other plants of the same kind, afforded nutriment to the blossom and seeds; and experiment soon satisfied him that his conjectures were well-founded. The experiment he describes, which is very simple and ingenious, is this:—He fixed strong stakes in the ground, and raised the mould in a heap round their bases; and in contact with the stakes, on the south side, he planted the potatoes from which he wished to obtain seed. When the young plants were about four inches high, they were secured to the stakes with shreds and nails, and the raised mould from the bases of the stakes was then washed away from the roots, by a strong current of water applied from the spout of a pan, so that the fibrous roots *only* of the plants remained in the soil. The fibrous roots of the potato are perfectly distinct organs from the runners, which give existence and convey nutriment to the tubers; and as the runners spring from the under-ground part of the stems only, which were, by the washing away of the mould, placed wholly out of the ground, the formation of the tubers was easily prevented by nipping off the runners, and whenever this was done, nume-

rous blossoms produced fruit and seeds. As this is the most natural method of obtaining seed from the early kinds, the propriety of using it is not questionable; but when seed of young healthy late kinds can be otherwise procured, it is preferable, and it can be procured in certain parts of the country. Some of the correspondents of the Quarterly Journal of Agriculture say they have recently raised kinds in a state of full seed bearing.

By Mr Knight's contrivance, seed of *any* kind can not only be obtained, but the immediate connexion betwixt the plums and the roots is fully established. Thus, to cause the stems produce seed abundantly, take off the tubers; and, on the contrary, when they produce seed in great abundance, take off the blossoms, and the tubers under ground will increase to the estimated amount of a ton per acre in a field of healthy potatoes. It is a general mistake to suppose, that to rear new kinds from seed to a full size, is a work of years. Under proper management, this object may be attained in two years. But to proceed—The plum is generally ripe in October, or early in November. When ripe, they assume a blackish colour. Select the plums from the best stem, proceeding from the root. On removing them from the stem, hang them up in a dry place until they begin to become soft. Then bruise them down in water, and by placing them in a drainer, wash off all the pulpy substance, and strain the seed tightly in a cloth until it be dry, and spread it upon a sheet of paper. Let

it so remain, in a dry room, for a few days, changing or drying the paper occasionally. In a short time the seed will be so dry as to admit of being put into a paper bag for keeping. It should be kept in a moderately dry place, as any seed, and particularly those of the pulpy kind, is easily injured from being over-dried. Another way of preserving seed is still simpler :—Pack the plums among dry sand, and hang them up in a dry place, inclosed in a bag, until spring. The sand will absorb the pulp, and preserve the seed. Two objections present themselves, at first sight, to the latter method, from which the former is wholly exempted. Neither the quantity of seed thus obtained is known, nor is it possible to *sow* the seed with the precision of the other method. I would therefore recommend the first-mentioned process as the preferable.

The seed-bed should be prepared in autumn, make choice of a piece of light free soil, in a warm sheltered situation in the garden. A bed of twelve feet long hy four feet broad, will hold a larger quantity, but it may be made more or less, as may be requisite. Cover the surface of the bed with four inches of rich well-rotten summer-made dung. Dig it in, and allow it to remain in a rough state through the winter, in order that the frost may penetrate more readily. In dry weather, about the end of March, or beginning of April, dig it again, breaking and mixing the soil and the dung. Allow it, after this, to remain for a day or two untouched, that the surface may dry. Then hoe it over pretty deeply, two or three

times, at intervals, with the push-hoe, to break the surface. Next, rake it smooth and level, and after removing all stones, &c. form the drills, by placing the shaft of the rake across the bed, and pressing it into the surface to the depth of about half an inch. Into these grooves run the seed, by rubbing it betwixt the finger and thumb as regularly as possible, and then with the rake draw on a light covering of the finely pulverized mould, not above one-fourth of an inch in depth. All very small seeds require a very finely broken soil to braird in. By all means choose dry weather for the operation, and do the work in a neat manner. The bed, when finished, must be protected from fowls and birds, as a very trifling affair will disturb the brairding. As soon as the plants are up so far as to render the rows discernible, run the push-hoe lightly between them, in order to cut the small weeds, and by stirring the surface, encourage the growth of the plants. Repeat this frequently, and pull up every weed in the rows. If the plants appear to be very thick, begin early to thin, but do it by degrees, as they will thrive the better of being allowed to be pretty thick when young, and should the mornings prove frosty, they will be better fitted to resist it. To guard effectually against frost, however, it will be proper to prepare a quantity of green spruce-fir branches; from their peculiar fan shape, they answer the purpose better than any other thing I know of. Have them lying beside the bed, and if the weather threatens to be frosty, lay a light cover of them over the beds every night, and remove them in

the morning. There are other more expensive methods of covering, such as using bass matts, or by sowing under glass frames, which latter is doubtless the best method, both for preservation from frost and encouragement of growth. With attention, however, it is quite possible to raise them in the open air. A rich soil, kept free from weeds, will soon force the plants forward. If the weather is dry, after hoeing, water them of an evening. By the time they are an inch in height, thin them to one inch and a half distance in the rows. Earth them up a little, and from this time they will require less frequent attention. Being so thinned, allow them to acquire roots fitting them for transplanting, which they will be by the time they are from three to four inches high. The process of transplanting should take place early in June. In a seed-bed of about twelve feet in length, there will be fourteen rows, at ten inches apart, each row containing about thirty plants, in all about four hundred of a proper size for planting.

The ground designed for transplanting must, like the seed-bed, be also prepared in autumn. Dig a good quantity of dung into it; re-dig it in spring, and when the time for transplanting arrives, it should again be turned over, and the soil sufficiently broken, and mixed with the dung. This done, lay it off in drills with a line, sinking each drill about four inches deep. Choose dry weather for the operation, as then the ground will work clean. Along the bottom of each drill pour two large panfuls of water, to damp the soil effectually below the plants. This is the

most effectual method of watering plants about to be transplanted. Proceed to take up the young plants, in doing which be careful to preserve the fibres. Lay them carefully into the drills, six inches apart. Draw a little fine earth to the fibres. Go along each row with the pan, and give it a gentle watering, which mixes the earth with the tender fibres. Then draw the remainder of the earth to the plants, and press it gently with the foot, and the operation is finished. If the weather prove dry, an occasional watering in the evening will have a good effect; and when they have taken root and begin to grow, earth them up as they may require it, and the first season's operations are finished.

By transplanting in the first season a whole year's growth is gained. If the soil be prepared as directed, the young tubers will generally attain the size of pigeons' eggs. Take up in autumn when the stalks begin to decay, and select from each stalk two of the largest tubers. Reject the others and such stalks altogether as are of an inferior and ill-shaped description. To keep them safely through winter, put them in a box; procure a quantity of sand. Lay first a layer of sand in the bottom of the box, then lay the potatoes in rows, and also in pairs, each kind together; then fill up with sand an inch above the first stratum of potatoes, and so on until the whole are deposited. Keep the box in a house secure from frost until the planting season. The second year they may be planted in the field. Fill the drills well into which they

are to be planted with rich compost; plough the earth over it in the usual way. Smooth the top of the drills, then with a hand-hoe make a furrow of three inches deep along the centre of the drills. Take the box to the field and take out the potatoes carefully in pairs, and lay them into the drills uncut, a foot betwixt each, and two feet betwixt the kinds; cover them three inches deep. When the plants get above ground, and of proper growth, pare the drills off; hand-hoe betwixt the plants, and plough up at the proper time. Go along the drills with the hand-hoe and adjust the earth carefully to the plants, and the second year's operations are completed.

When the potatoes are ripe in autumn make choice of a dry day to raise them. Turn them all out, each kind by itself, and allow them to be above ground, then go along and make a careful inspection. Now is the proper time; by keeping two potatoes from each stalk the first year, and giving each couple an equal space of ground the second year, a fair impartial trial is given to all the kinds. Reserve such of the kinds as appear most promising; keep the whole of them, and secure each kind separately in narrow pits for seed next spring. The third year plant all the selected kinds separately, cutting all the large ones and planting the small ones entire. Again in autumn examine the stock, when their qualities may be put to the test. All new kinds are watery at first, but those which are found to be too much so should be again rejected, keeping only those possessing supe-

rior merits. I have recommended strong manuring when the kinds are young, as it is by the strength of manure and judicious management that they are forced forward. That the potato will continue to be subject to decay after choice new kinds shall be procured from seed taken from healthy plants, I think is highly improbable for at least many years thereafter.

APPENDIX.

This work was nearly finished before I saw the late Numbers of the Quarterly Journal of Agriculture, the Prize-Essays of the Highland and Agricultural Society of Scotland, and a file of the Ayr Advertiser from 6th October to 8th November 1836, all of which contained valuable papers on the subject of the failnre of the potato crop. From the coincidence of several of these essays with my views, and the opposition of others, I have considered it necessary to make extracts from some of them, which I have accompanied with remarks, availing myself of their able support when we coincide, or where we differ, shewing wherein they are wrong.

In consequence of the partial failure which took place in the potato crop of 1833, the Highland Society, in the following year, offered a premium for the best essay on the nature and causes of the injury or disease, and on the best means of preventing or palia-

ting it in future. Upwards of twenty essays were received, and to the authors of one of which, Messrs Macdonald of Huntly, the premium was awarded. At the same time the silver medal was voted to Messrs Walker and Winder, Liverpool, for an essay, which was considered next in merit.

The Messrs Macdonald state that the whole cause of the disease proceeds from the heating of the seed, by allowing it to lie in heaps for some weeks after it is cut previously to planting. By an inadvertency of this nature they lost a great part of their crop in 1832 and 1833, but saved it in 1834 by the precaution of cutting the seed only when about to be used. They consider the disease is the cause, not the effect, of the worms in the sets. They do not think there is any inherent decay in the potato. They say it is quite common on opening a pit in spring to find that all, or the greater part, has germinated, which shews the health of the potato; and they say, that the fact of the second planting succeeding after the first had failed from the same seed, also proves the same thing.

Messrs Walker and Winder are of opinion that insects have nothing to do with the disease. That raising the potatoes before they are fully ripe, a bad method of storing in houses or pits, heating in pits or houses more or less promoted by the mildness of the seasons, encouraging premature growth, and thereby destroying the vegetative powers, are the sole causes. They think that any diminution which may have taken place in their natural vigour is owing to their having been overheated, and prematurely forced to vegetate.

And with respect to their permanency, they are inclined to believe that any variety of the potato, cultivated by means of tubers, may be continued unchanged to any length of time, provided due care be taken in its culture. But they admit that the potatoes are at present weakly and defective; the result, they consider, of the late mild seasons, and as a return of frosty seasons cannot be depended on, recourse ought to be had to seed from crabs. Until a supply of such is got, the tubers of the present kind ought to be planted whole, or the rose end only used. The manure, they say, should be incorporated with the soil; or at all events, the soil should be raked or brushed over the manure before depositing the sets. That the sets should be of large size, and planted as soon as cut, with the skin side to the manure. The best season for planting, they add, is April, earlier or later according to the state of the land and weather. Their method of winter preservation, I shall give in their own words:

"The crop should be thoroughly ripe before they are dug, and after having been allowed to dry and season on the surface of the land, they should be stored so as to be kept dry, cool and free from untimely vegetation, whether kept in potato houses, cellars, or pits. Expedients for effecting this will readily suggest themselves." In the case of pits, the authors recommend, "that, when putting in the potatoes, narrow wicker-work funnels should be stuck up at regular distances along the centre, thus leaving chimneys or cavities from the bottom of the heaps for the escape of steam. When heaped up, the potatoes should

remain a while uncovered, except with dead tops; dried fern or straw, with the addition of tarpaulin covers over all at night and when raining, until sufficiently seasoned, when they may be finally covered with earth, sods being then laid over the chimneys at night and during rain or frost to prevent injury." In simplification of the last process, I would suggest a question—Did it never strike the authors that a much smaller quantity put together would supersede the necessity of air-funnels? Or, must we entertain an opinion similar to that held by the Chinese when told of the height of European houses. "It must be a poor place that Europe," said he, "when, for want of room, they build the houses one above the other." From the "General Remarks" of the reviewer of the above essays, I will make a few extracts. "The other essays with which the Society has been favoured, generally agree with the above, both in the causes of the failure and the means of preventing it in future; while most of the writers are decidedly of opinion that potatoes for planting should not be lifted until fully ripe. Others allege that unripe potatoes germinate better, and this chiefly on account of the great quantity of moisture which they contain. When there is any doubt as to the soundness of the tubers, they ought to be planted entire. In any case, if cut, they ought to be planted as soon as possible; and where it is difficult to do so, the sets might be covered with lime, or some other substance, as recommended by several of the essayists. To conclude: In whatever manner the discordant statements made by some of the writers of these essays may be viewed, it will

seem that the best supported opinions are to the effect, that the cause of the failure exists in the deterioration of the tubers by injudicious management; and that it may be prevented by preserving them from being heated, and generally by bestowing more care on the cultivation of this most useful plant. With respect to insects having caused the failure, almost all are agreed that there is no foundation for such an opinion, and that wherever worms have been found, they have been a consequence, not a cause, of the partial or entire decay of the sets." With these remarks, I find that Mr Anderson, to whom the Royal Dublin Society adjudged the premium offered in 1834 for the best essay on the cause of the recent partial failure of the potato crop, exactly coincides with those of the majority of the writers who have favoured the Society with their observations. I have already stated," says he, "that, during nearly two hundred and fifty years, there were no instances of failure similar to those which have lately occurred; and I have ascribed the recent failure to our altered system of cultivation deferring the time of planting to a later period, and taking up the crop in an immature state. I shall now endeavour to explain and illustrate the evil consequences of this change. The potato lying in the ground during the winter becomes perfectly matured, retains its juices, is preserved from fermentation, and germinates at the natural season; and we have found that the plant proceeding from it is luxuriant and healthy. Under our treatment the tuber is taken up immature. It has, therefore, a

greater tendency to fermentation from its juices being more crude. It is heaped up in large quantities in close houses or pits, and these large heaps increase the tendency to fermentation. The time of planting is protracted beyond the natural period of germination, and the tubers become exhausted by germination in the pits, and when at last committed to the ground, they are frequently planted in mould, which has become dried up, and not unfrequently placed in manure, which is also dry and withered, from improper preparation or neglect, and are sometimes put into ground so rough and ill-prepared, that the air is freely admitted to the seed to dry up any moisture that may remain. If seed be perfectly sound and uninjured, it may be able to surmount the obstacles which improper management at the time of planting opposes to its germination. But when injured, and its powers of germination weakened, it may fail to overcome them."

Thus it appears that a large majority of writers on the subject are of opinion that heating of the cut seed, while lying in heaps previously to planting, improper keeping in the pits or houses during winter, premature growth in spring, and particularly unripe tubers, are the primary causes of the decay; and that there is no inherent degeneracy in the plant, and that any healthy variety of the potato, if treated with proper management, may be continued in perpetual existence. From all these opinions, I more or less disagree. The heating of the cut seed, with all the other improper usages to which it is subjected, I

hold to be secondary causes only, in accidental connexion with the primary cause, namely, an inherent liability to decay in the plant, in consequence of its peculiar method of propagation. I reject entirely the perpetuity of the plant; and I hold decidedly the opinion of the minority of the Essayists, that green tubers are by much preferable to ripe ones for seed. In this case the Essayists have rejected all former experience. Was it not proven twenty or thirty years ago that green tubers was a temporary cure for the curled leaf? It seems also to be forgotten that propagating the potato by cutting the tubers is analogous to propagating fruit-trees, &c. by grafts or cuttings, and who that understands either of these processes would prefer old ripe wood to green fresh shoots?

Mr Anderson says, "The potato, lying in the ground during winter, becomes perfectly matured, retains its juices, is preserved from fermentation, and germinates at the natural season, and that we have found that the plant proceeding from it is luxuriant and healthy." I say so too, and in imitation have recommended keeping all seed potatoes in a manner as similar as possible to those kept in the ground. That such produce healthy plants I admit, but that green tubers kept in the same manner are superior I have not a remaining doubt. Suppose two potatoes laid together in the earth in autumn, the one perfectly ripe, and the other quite green, I need not ask Mr Anderson from which tuber he would expect the earliest, the most vigorous, and most abundant produce, for I already know what his

answer would be. But I would ask him, has he seen or known the experiment made? I profess to have done so, and therefore am prepared not only to *speak* decidedly as to the result, upon my own convictions, but also to give reasons for it, which, if my veracity is to remain unquestioned, must produce the same effect upon the minds of others. Here are the reasons.

In 1832, the Highland Society offered a premium for the best descriptive account, founded on actual experiment, of the different varieties of the potato best adapted for field culture. It was required that the report should detail the names, general characters, productiveness, keeping properties, and mode of cultivation. The premium was adjudged to Mr Andrew Howden, Lawhead, East Lothian, whose report was published in No. 30 of the Quarterly Agricultural Journal. His tables shew ninety varieties of early potatoes, and forty of late, with their characters, in columns, of name, form, colour, quality, health, strength of stems, flavour, and produce. The greater part of the whole were grown on his farm, on a comparative trial of three years. Some kinds appeared to produce one-half, and even four times more than others, in every respect, under the same management. Some were healthy and strong, others shewed symptoms of decay. Hence the propriety of selection. I shall here give a few extracts from his essay. "In spring 1832 I set apart two ridges, each sixteen feet wide; to these I applied decomposed farm-yard dung, at the rate of sixteen tons per acre, spread over the surface, and ploughed

in, deep. The second week of May one hundred potatoes of each variety were selected and planted whole, with the spade across the ridges, in three rows, each kind at a distance of twenty-seven inches from each other. The crop was kept clean and earthed up with the hand-hoe, and the whole taken up in the second week of October, each lot heing correctly weighed, numbered, and put into separate pits. Crops of 1833 and 1834 were managed exactly in the same way." * * * * * * "It will be understood that, in each of the respective years, all the varieties have been grown under the same circumstances, as to soil, manure, and culture; and, in the two last years, from tubers produced under the same circumstances the previous season. This is a particular which I think indispensahle in determining the value of the different varieties. But even, when we observe this, we have still much to learn; because different varieties are more or less adapted to different soils and climates. This I found to be the case with several varieties which I had planted in 1833, upon the top of Traprainlaw, upwards of seven hundred feet above sea level; and upon the farms of John's-cleugh and Mayshiel, perhaps at double that height, being about the highest cultivated land in Lammermoor. To Mr Renwick, the farmer at Mayshiel, I feel much indebted for the trouble which he took, and, from the attention which he gives, many besides me are henefited by the superior seed potatoes which his farm produces." This is an acknowledgment on the part of a skilful agriculturist, of the superiority

of green over ripe seed, as in such high districts the potato seldom has time to attain to perfect maturity. Mr Howden states his experience in respect to taking off the blossoms from potatoes in the following manner: "All the kinds under the experiment were allowed to blossom and produce apples as nature prompted. In other years I have practised pulling off the blossoms, and the effect seems to me to depend very much upon the nature of the season. In years when the apples are plentiful, I have seen a difference of nearly a sixth gained by pulling off the blossoms; whereas in other seasons the difference was a mere trifle." Another passage shews the advantage of planting whole potatoes. "In 1832 I had ten sacks, each containing different kinds sent me from Ireland. With a part of their produce I planted in 1833 nine hundred yards upon one drill, with whole potatoes; and the same extent with the varieties cut. The whole potatoes were placed in the drills, eighteen inches apart, and the cut at twelve inches. When taken up and weighed, the produce from the whole potatoes exceeded the other by 811 pounds; but I found more small tubers in what was produced from the whole potatoes." This last is a different result from what several experienced cultivators have found. He adds, "The impression which the experiment has left with me is, that the *Lumpers* and the *Cups* are valuable, and safe to grow for cattle, because they cover the ground well in, do not curl, and produce great weights. I make this remark upon nearly twenty years' experience. I shall continue to

grow the Wellingtons and a few others, the weight of which stand high in the table. In the fall of the year, for family use I should prefer the white and blue Dons, and in spring the old rough black and Irish apple. Through summer, after the ash-leaf, I would recommend Dudgeon's black early, and the Flamingo or red early, none of which seem liable to disease."

In No. 31 of the above Journal, a letter from a farmer, extracted from the Belfast News Letter, observes, in regard to coating seed with lime, " Is it not a fact that experiments were made in 1834, and which have been largely and successfully acted on in 1835, of forming a skin over the fresh cut surfaces of the sets, by rubbing them on lime powder, thus to exclude the atmospheric air, and to retain the moisture in the sets. That when treated in this way, although they remained unplanted for a considerable time afterwards, they grew vigorously if the seed was juicy, by being chosen from imperfected roots, though languidly, if the seed was hard, dry, and farinaceous, by being cut from thoroughly perfected roots, but still they grew, shewing the value of the protective process; while those sets from the same parcel, cut on the same day, and exposed for the same length of time, but wanting such protection on their cut surfaces, failed entirely." His concluding remarks are these: " In fine, to realize a luxuriant field of potatoes, such as the writer of this could shew at present, it is only necessary to see that the following operations are well performed:—First, A thorough spring preparation of the ground, in other words, working

it well with plough, harrow, and roller, so as to accomplish complete pulverization, taking care to free it of root weeds. Second, To use dung which is sufficiently decomposed. Third, To choose for seed those potatoes which have not ripened, or come to perfection the previous year. This is a very important point. Fourth, To cut the sets large and strong. Fifth, To plant them as soon as possible after being cut, turning the cut side downwards, and to cover them as soon as possible. With this management, a good braird of plants will be obtained; and, having this, their future rapid and vigorous growth, and ultimate produce, will depend a good deal on the attention paid to their cultivation by the summer operations of horse and hand-hoeing." In these general prescriptions, this writer substantiates much of what I have said.

On the degeneracy of the potato, in No. 31, Quarterly Journal of Agriculture, Mr W. Paton, Greenaby, Bred, Isle of Man, says, " I believe it will be found, that, where disease has been found most prevalent, it has affected most seriously those sorts of potatoes, which, from their superior quality, have been cultivated for the greatest length of time; and that it has been most destructive among those sorts which have heen marked by peculiar delicacy. This clearly shews, that there must be some cause of the disease in the potato itself, which may, indeed, be increased by external causes, but which at the same time must be regarded as independent of them. With these views, I consider that the means of preventing

the taint must be applied, both to the removal of whatever of an external nature may be found injurious to its health, and also to the counteraction of its internal causes of disease." * * * * * He proceeds to shew, that there may be external causes, which, in connection with the internal, act unfavourably on the crop, such as aridity of the air, or too much external moisture when accompanied with chilling cold, the use of unfermented manure, soil not sufficiently pulverized, the potatoes being cut, their being deprived of their first and strongest shoots, fermentation before and after cutting,—these he regards as serious injuries, which, although they may not affect the coarser and hardier sorts, are destructive to the more delicate, and particularly to those which, on account of their superior quality, have been long in cultivation.

He then continues, " We now come to what I consider the very root of the evil, namely, a predisposition in the potato itself to receive the disease in question. This predisposition I conceive to result from its having degenerated, in consequence of having been subjected to a long course of artificial cultivation; and therefore, that our attention must be directed mainly to the means of preventing this degeneracy, while we endeavour to remove all such external causes of the disease as may be under our control. That the potato, in common with all other productions of the vegetable world, has a tendency to degenerate when the laws of nature are deviated from, must be granted. And considering that it is not a

native of this country, it is reasonable to expect that it will degenerate in proportion as means are neglected to prevent it from doing so." He further very justly observes, "With respect to the potato, nature clearly seems to have made provisions for the permanent health, as well as for the productiveness, of her own offspring, in the seed contained in the berry which the plant produces from its stalks; and consequently, by our endeavouring to perpetuate any particular sort of potato, by continually cutting, and planting its tubers, it is reasonably to be expected that we shall injure its general properties, and thus gradually render it less fit for food.

"If the foregoing observations should be deemed correct, it will follow that, in order to be as certain of obtaining a good crop of potatoes as is possible to be, the ground, before being planted, should be thoroughly pulverized, the manure should be well fermented, the sets should be whole potatoes, and never deprived of their first shoots, nor allowed to ferment; and lastly, that a constant succession of new sorts should be raised from the seed. The newly raised sorts would doubtless admit of being cut with safety for several years, and would be but little affected by external injuries, unless peculiarly delicate, as they would possess all the health and vigour of a plant propagated according to nature's laws."

By attending to these suggestions, he says, long experience has convinced him that there is little danger of missing a crop. He takes no notice of using green tubers, nor proposes any particular method of

preserving them during the winter, and therefore we are left in the dark as to whether he considers any such precautions to be necessary. In the year 1833, he raised a great variety of new sorts from seed, which, he says, are doing well, while old kinds, in the same field, are both tainted and curled.

On the 1st July 1836, the Highland and Agricultural Society of Scotland circulated a number of queries to agriculturists, respecting the failure of the potato crop, in answer to which numerous papers have been received by the Society, containing a mass of valuable information, which is ingeniously arranged and ably reported to the Society by Mr Charles Fergusson, younger of Kilkerran, Ayrshire, and published in No. 36 of the Quarterly Journal of Agriculture.

The information gained, although valuable, is still incomplete, and from all that has yet been shewn, nothing has appeared to put the cultivation of the potato on a sure basis. The cultivator is left bewildered with a number of conflicting opinions, but no rule founded on experience, and agreeable to nature, is laid down for his direction, shewing how the evil may to a certainty be overcome. On certain points there appears something like harmonious agreement among the writers, on others entirely opposite conclusions are drawn.

Mr Fergusson justly observes, in the introductory part of his report, " That a mass of valuable information has been communicated, and the opinions of practical men, residing many miles apart, are now to

be arranged in juxta-position, so as mutually to confirm and illustrate each other; their joint influence being the result of no common understanding, and suggested by no previous intercourse, ought therefore to induce attention to their counsels, since agreement in error on points of practice and individual experience may be held to be all but impossible."

"The plan," he says, "which I have adopted in preparing this abstract, has been, (1.) To note the points on which each writer touches, and his opinion upon it; (2.) To place together under distinct sections, and in continuous order, the sentiments, and frequently the language of the several writers regarding these several points; (3.) To sum up at the conclusion of each section the collective opinion of the whole, in so far as there seemed to be agreement, or, on the other hand, where discrepancies of sentiment presented themselves, to point out these, drawing in either case such general conclusion as might seem warrantable.

"By this plan a combined succession of precepts for the proper cultivation of the plant, of opinions regarding its present condition, and of the most likely methods for obviating or removing any weakness or disease which may be found to attach to it, are given in a clear and definite arrangement, so that the views of the different writers upon each branch of the subject are seen at a glance, and the value of what they say can be at once appreciated."

As answerable for my purpose, it is only neces-

sary that I give a shortly abridged view of this excellent report. The seven heads or points into which he has arranged the evidences of the different writers are,

1*st*, The proper period for planting. On this seven of the writers are agreed, and recommend *early planting*, some as early as January to March, and early in April as the latest safe period. With such I do not agree, or would advise it as a judicious plan. Early planting is not in all cases practicable; the crop will not generally be so good; the soil cannot be so effectually pulverized, or weeds destroyed, as when the ground is wrought during good dry April or May weather; and all that is gained by such early and unseasonable planting, is simply that the seed is got deposited in the soil before being exhausted by premature growth, and the first vigorous efforts of the root to shoot is taken advantage of; but let the seed-roots be preserved through winter in the manner I have described, and there will be no *necessity* for early planting.

2*d*, The period of lifting, and whether seed should be ripe or unripe. Five out of six whom the reporter quotes, are of opinion that the seed-roots should be taken up in a green sappy state. One is decidedly for ripe seed, and insists that unripe seed runs greater risk of sweating, heating, &c. In this last opinion several others also agree But I would say there is no danger on this score, provided the plain dictates of nature are attended to, to keep the

roots imbedded in their natural element, the earth, without any other covering, and they will remain quite sound and fresh, and will not be forced to shoot before the natural season. I am therefore decidedly in favour of green seed.

3*d*, The proper mode of preserving potatoes intended for planting. The opinion of five writers are produced, and, the reporter observes, more evidence on this point might be adduced; but he contents himself with these as sufficient for recommending due attention to keeping the potatoes cool and moist during winter, and for suggesting a simple method of doing so in narrow and ventilated pits, and allowing the potatoes to remain in the ground where they grow until the time of planting. Narrow pits are doubtless better than large ones, ventilated than close, and remaining in the ground better than either. But all these methods are defective; the last is so in allowing the seed-roots to be over ripened, but the last defect might be greatly prevented by cutting the stalks when quite green, and then covering up the crop with earth. I would recommend my own plan of shallow-earthed pits as preferable to any other. I have seen its good effects for thirty years, and it is not at all troublesome, I should rather say it is the simplest of any other plan.

4*th*, The state of the soil. On this particular a great deal is said by the writers, and it is a point of importance. The state of the soil doubtless influences the growth of the plants. I would freely enter

into the views of the numerous writers on this essential point, did I recommend planting the seed when the dung is put in, but I differ from them in this respect, the changeable state of the weather rendering such planting precarious. I have recommended proper pulverization of the soil, and my plan gives of all others the best opportunity of performing it; but I would decidedly say, do not put in the sets until the dung has lain some time in and exchanged juices with the soil, and the field has undergone the necessary processes of ploughing, harrowing, or rolling. Then let the drills be split, and tested seed put in at the same time, and the certainty of the crop will be placed beyond doubt.

5th, The dung, its best state for encouraging vegetation, &c. &c. On this head, what the reporter quotes from ten writers is very harmonious. This point I need not dwell upon, for, in my system of putting in the dung at any time in winter or spring, and operating on the soil with plough, harrow, or roller, previous to planting the seed, fewer precautions in regard to the state of the dung are required; but well-rotten, cool dung, is undoubtedly the best, and every judicious farmer will use none else.

6th, This section refers to a very important part of the subject, viz. the *seed potato itself*, from what localities it ought to be procured, and whether it should be planted entire or in cuttings. Fourteen writers are quoted, a number of whom approve of a change of seed from a high district, or cold-bottomed land,

to low fertile soils, as a sure and long-experienced remedy against failure in the potato. Planting entire seed is also recommended as another sure remedy, or, when cut seed is used, coating with lime, or steeping in water, is recommended. These remedies I have recommended, but I do not consider that they are of themselves sufficient. Unless something more effective is done, there will still be an uncertainty as to the result.

7th, This embraces the last and most important head, which is, *whether the plant is weakened or worn out*, and whether it is expedient to cultivate it more by means of the apple, and less from the root, than has of late been in use to be done. On this subject there is a very considerable difference of opinion. I here give the reporter's own words. In summing up, he says, "In the results of the opinions given by the previous twelve writers, we find considerable difference of sentiment regarding the fact of deterioration, and still greater regarding the safety or expediency of employing the remedy of renewing from the apple. Three among them seem to say there has been a general deterioration; one confines the failure to the Perthshire reds, another, while he speaks of a general failure, excepts the kind called *cups*, while two very experienced persons are as decidedly opposed to the idea of there being any tendency in the potato to wear out with ordinary treatment, and one of these presents us with an instance of a potato constantly planted and replanted in his

own ground for sixty-five years, and this the only kind which did not fail him during the recent years of failure. Another again says, "That the theory of deterioration was broached previous to 1792, at the time when the *curl* was as prevalent as the *dry rot* now is; whereas he never heard of the curl until the remedy now proposed of cultivating from the apple was adopted; and these incautiously selected were, he believes, the real cause of the introduction of curl. Four recommend a careful selection of the apples. One to go to the original of the potato to be found in subsoils. Three have found a careful selection of the apples succeed. Three have found potatoes recently from the apple fail. What deduction can be drawn from such conflicting testimony? Why, truly, caution in the use of a doubtful remedy, which requires much skill in order not to aggravate the evil." * * * *

I am fully satisfied in my own mind that the potato is decayable; that, as planting from the roots does not change the kind, the latter continues the same; and, however long continued, it is still the same plant. The only possible restorative is to be found in the seed. This is the usual means by which all nature is kept fresh and vigorous, and the globe clothed with healthy herbs and trees. The seed organs are given to plants for the performance of two grand objects,—the renewal of the plant, and the improvement of its varieties, without which latter property, there could be no change from the

original. What in this world, either of animal or vegetable nature, is denied the possibility of progressive improvement? But to promote improvement, and render it beneficial to man, judgment and ingenuity on his part are necessary to choose seed from healthy plants, and scrutinize the kinds when obtained, selecting the most healthy, firm, and consistent. That certain varieties should fail early, and others hold out long, is only what may be expected from the difference in constitutional strength which the different varieties may reasonably be supposed to possess.

The renewal from the green excrescences that grow on the stalks above ground, as advanced by one of the writers as an effectual remedy, cannot, consistently with nature, be so. It will, I allow, prove a temporary remedy, and be useful under present circumstances; but, as it cannot change the kind of the plant, the renovation of the plant cannot be complete. It will only be a continuation of the same plant, and mere continuations must partake of the frailties of their progenitors, unless the supporters of the durability of the potato can shew that it is endowed with the imperishable consistence of granite.

In the Ayr Advertiser, a letter appeared by Mr Alexander Montgomery, Bridge-end, who is of opinion, that the disease of the potato is caused by an insect. His opinion, with which I do not coincide, led him to adopt submersion of the seed in lime water as a preventive of the ravages of the supposed insect. He says, " Upon the supposition that an in-

sect not bred in the potato was the occasion of the failure, and which could not penetrate the skin, it struck me, that, if I could succeed in giving the cut part a coating of any thing that would he equally impervious, and not injure its growth, I should prevent it. For this purpose, I made mixed lime and water to the consistence of whitewash, and, when cool, immersed the sets in it by means of an open garden basket. As those to whom I mentioned my intention thought the lime would prevent the seed from germinating, I tried it on a small scale, *i. e.* a drill in two different fields. In one drill there were *two* failures, in the other *one*; while the same seed planted in the usual way on both sides of them, failed to a great extent." * * * * * "I have such confidence in this, that I will not fail to coat my sets with it next year." I agree with Mr Montgomery, that lime is effective in destroying vermin, although I do not believe that any insect is the original cause of the disease in the potato. Lime may be otherwise beneficial, particularly hy acting as a stimulant to vegetation, as has heeu ingeniously pointed out by Mr Rohert Limburn, from whose essay I give the following extracts:—

He says, "In the cotyledons of seeds, and in the cells of tubers and bulbs, is deposited a substance denominated Alhumen, from its resemblance to the white of an egg, and is destined in spring to nourish the young embryo germ or bud till fully developed, and enabled, by its roots, to seek for nourishment

itself. The strength of the first shoot depends on the quantity of food furnished to the embryo or bud; and on the strength of this shoot depends, in a great measure, the future vigour of the plant." He then gives an analysis of this "albumen," shewing its parts to be of mucilage, gum, sugar and starch; how these may be resolved into the three elementary substances, carbon, oxygen, and hydrogen; and adds, "If the seed or tuber is taken up when germination has commenced, the albumen will be found converted into a soft mucilaginous substance, which is the food of the embryo converted into a soluble state, and is conveyed to the neck of the germ, and from thence to the ascending stem and descending root. The ripened seed or tuber contains more starch than the unripe, being converted in the act of ripening, by the continued deposition of carbon, from a soft mucilaginous into a solid floury condition. In the soft state, the food is more easily converted into a nutritious substance for the young plant, starch being more difficult of solution; but it is a wise provision of Nature to preserve this food from destruction. An unripe seed or tuber is thus found to vegetate more speedily and surely, but is much more difficult to preserve in a sound condition; and hence the reason why potatoes taken up before fully ripe are found to succeed better than when very ripe, dry, and floury." I pass over a number of his observations, which may be considered too scientific for this plain work. He next describes the benefits to be derived from lime, and

gives as an example the good effect it had on three-year old spruce-fir seed. He says, " In corroboration of this may also be mentioned some experiments narrated by farmers in the newspapers this year, in which, having spread the cut potatoes on a floor and sprinkled them with lime, they grew much better than others wherein this had been omitted. In dry seasons and cold, this process will be of essential benefit in assisting to reduce the starch of the potato to a soluble food; and, in very ripe, dry, and floury potatoes, should never be omitted. We have seen that heat and moisture are both necessary in preparing the food of the embryo, but, when either of them are presented without the assistance of the other, their action is very prejudicial; and hence we find the bad effects of too much moisture in reducing the seed or tuber to a state of putrefaction, and of long-continued drought or heat, in so drying up the seed or tuber, that, even when rain comes, they either do not vegetate at all, or else in a very weak condition. It is therefore my opinion, that to the long-continued drought of the three last springs may be attributed the principal cause of failure in the potatoes." He concludes by observing, that renewal of potatoes from seed should be more looked after. " Having had," says he, " a good deal of practice in rearing, and seeing reared, flowers from seed, especially the ranunculus, I have invariably found, that those most recently from the seed had so much more vigorous growth, both in the foliage and flowers, that it has

become customary for florists to be able to point them out in each other's flower-beds from their appearance. In raising of new gooseberries also from seed, it is invariably found impossible, in subsequent years, to produce the fruit of a weight equal to what it has attained on its being first shewn; and I have no doubt, that potatoes will conform to the same rule, and that those newly raised from seed will be found to possess more vigour of growth than after they have been planted for a long succession of years." It here appears evident, that I am supported in regard to the propriety of green seed on principles so sound, as not to be easily controverted. I am also borne out in my opinions, that all tuberous plants that are continued in annual succession by replanting the roots, and all fruits that are propagated by cutting or grafting, are, in common with the potato, decayable from age.

Mr J. W. Murray of Lightshaw, writes a very judicious essay on the disease. He discards the early ideas of the disease being in the soil or the dung. He also scouts the theory of insects, and finally adopts the opinion, that it is to be found in the potatoes themselves, "though, no doubt, modified by circumstances, and influenced by both soil and manure." He compares the potato to the apple, or other grafted fruits, and says, "Some who wrote first on the diseases of the potato, ascribed it to planting potatoes which had not been fully ripe." This, he says, he conceived to be an error, arising from their not considering that the tuber is not the seed; the

propagation of the potato by the sets, being analogous to propagating trees by the slip or graft. He gives an analysis of the potato, and shews by its component parts, in different stages, *when* it contained *most* parts of starch and least of mucilage, namely, when ripe. He also analyzed the potato in two portions; the top, or end farthest from the runner or chord, he found to contain more mucilage than the root end, or that attached to the runner or chord." He says, "If then, the consistence of the potato, as well as its vegetative powers, depend on the mucilage, any treatment that has a tendency to lessen or destroy that substance, will also lessen or destroy its productive powers. Now, it is certain, that propagating potatoes by the set, and fully ripening them year after year, increases the quantity of starch and lessens the mucilage; but the deficiency of mucilage does not only weaken the vegetative powers of the potato, but also predisposes it to the rot." * * *

"It was also found out long ago by farmers on low and early situations, that potatoes brought from a moss soil were better for seed than those of their own growth. The truth is, that superiority did not altogether depend on their being grown in moss, but from the circumstance of their not having been fully ripened for many years, and of course being less rich and mealy, and having more water and mucilage in their composition. If the above reasoning be conclusive, the disease which has been the cause of the failure in the crop is the rot; and the cause of

that is a deficiency of mucilage in the potatoes used for seed; and the cause of *that* deficiency is early planting and late raising on early soils. If this be correct, the cure is obvious and easy; first, to procure seed from off a cold damp soil, and that had been raised before they were ripe, and afterwards to plant those which are intended to be kept for seed late in the season; and to be sure to raise them before the dark-green colour of the foliage begins to fade, and to keep them in their pits to prevent them from heating. I would, also, recommend either to plant them whole, if not very large, or at least to use only the rose-end for seed. If potatoes are sound, I am persuaded that two or three healthy sets may be got from the rose-end, and the rest of the potato may be given to the pigs or cattle." * * * *

"A curious circumstance was communicated to me by a friend. He had part of a field of potato land let out to cottars, and one of them who had been planting his lot, having about a peck of cut potatoes left, brought them into the house. His daughter cast them into a pail of water, on purpose to wash them to boil for the pigs. Another cottar, who was planting his lot the day following, ran short of seed, and came to borrow as many as would finish his lot. He was supplied with those that had been steeped for twenty-four hours, and had a very extraordinary crop from them; whilst the man who had planted them the day before in the usual way, had not one braird where ten should have been. Thus, we

have an instance of diseased potatoes being cured, by being steeped in water for twenty-four hours."

The following is extracted from a letter in the Ayr Advertiser, by Mr Alex. Reid, Bonshaw, Stewarton. He writes laconically and pithily thus—"To preserve the kinds now in use, until we procure a substitute, plant late and lift early those intended for seed. The more rapid their growth, the fresher will be the seed. In 1834 I planted potatoes, and lifted the produce, in two months afterwards; and sent some of them for trial to places where the rot had prevailed and not one of them failed; while others around them, on the old plan, were infected. Those skilled in botany need not be told that any seed or plant, when ripe, will decay sooner if left on the root than when separated from it. Even a tree, when dead ripe, will rot sooner if on its root than when cut. But when people are prejudiced to ripe seeds, they will soon destroy the very freshest kinds. I have not experienced those raised from the apple fail as yet, although they cannot be depended on, as a degenerated plant seldom produces healthy seed. Select the finest of the kinds of them, like the cattle-breeders. If we keep more for seed than two-thirds of them as they grow, they will soon degenerate. Plant those you intend for seed on the richest soil; lift them when the juice is in them; put them up dry by layers, of two inches of potatoes and one of earth."

"To extirpate the disease, go to the original kind

of potatoes that, if I am not mistaken, rise spontaneously from subsoils where I believe thousands of them may be found, in places even in Ayrshire, where neither potato nor potato apple-seed, has been planted in the remembrance of man." I am not prepared to affirm that the seed of the potato is *not* to be found in these unrecorded districts, but if I were extremely anxious to procure it from a *latent* source, I should be inclined to make my researches where it had been known at one time to have actually existed.

The extract from a letter by Mr Robert Gray, High Doon, in the Ayr Advertiser, says, " My seed was procured, for the most part, from a farm in the neighbourhood, of a thin clay soil, and very wet. The crop had been planted about the middle of June without manure, and was a very poor one; few of the tubers being larger than a pigeon's egg, and when taken up were not nearly ripe. I had them put in a pit, four feet wide at base, with a sloping roof. They were then covered with divots, and thatched over with straw. When taken up for planting, they were quite dry and firm, and had just begun to germinate. These were the kind called cups. The rest I planted were Scotch-reds, grown on my own farm and kept through winter in the same way. The cups, whether planted whole or in cuttings, produced an excellent crop. The red ones, when planted whole, also produced a good crop; but, when cut, they were nearly a total failure. The time of planting was during the driest of the season. I commenced, on the

28th April, to plant fourteen acres, and finished about the middle of May." Here, it appears, the small green seed, though far from being kept in a proper manner, all succeeded, cut or whole. The change, being from a cold wet soil to a dry, was on that account an excellent one. Had such a change failed, I might have thrown my *specific* overboard.

A method of preserving seed potatoes, fresh and sound, was recommended in the Dumfries Courier in June 1835, which was this:—Planting those intended for seed later, and in a corner or side of a field, and covering up the drills with earth, litter, or fern, to protect them from frost, and allowing them to remain so until the planting season. Last autumn several farmers in Wigtonshire adopted a similar and more effectual plan. They raised the potatoes from every alternate drill, and ploughed the earth over the unraised ones. This method, while it embraces the advantages of my plan, as to keeping the potatoes fresh and sound during winter, is defective in another respect; for although it keeps the seed equally fresh, it admits of over-ripening to such an extent as tends to reduce the tubers to a decayable state.

These constitute the reasons, confirmed by experience, which induce me to the belief, that the cultivated varieties of the potato are in a state of constitutional decay; and that, before we again possess hardy varieties, it is necessary they shall be raised from the true seed.

On the admixture of dung with the soil, Green and some other writers recommend a method of dunging potato-land which is practised in certain quarters, namely, spreading the dung on the ground and ploughing it into the soil, then harrowing well and drilling the land at three feet apart, and laying the seed in the bottom of the drills, covering it in with the plough and harrowing before the plants come above ground. Laying the dung into the drills, they maintain, is but poor practice, the plants not deriving so much benefit from the manure when laid into the drills as when mixed with the soil by the other process. Many of the tubers, they conceive, grow at a great distance from the stalks, and when the manure is not mixed with the soil, they, by being out of its reach, can derive no benefit from it. This, in my opinion, is but a weak argument, and discovers little knowledge of the nature of the growth and manner of the forming of the tubers of the potato plant. The tubers are not the *roots* of the plant collecting nourishment from the soil for the support and increase of themselves and the stalk; on the contrary, they receive their support from the roots and stalk, being formed at the extremity of and nourished by the runners that proceed from the under ground part of the stalk. The tubers being removed at a distance from the dung, receive no detriment, provided the fibrous roots find and are nourished by the manure, which, when applied in the ordinary way in the drills, must be directly under the fibrous

roots. Besides the dung, although laid in a body along the drill, is not, in its effects upon the soil, confined to the centre of the drill, its juices being soon absorbed by the soil to its whole width. To mix the dung as much as possible with the soil in the drills is doubtless an advantage, and by following the plan I have suggested, of putting the dung into the drills some time previous to the planting of the sets, may to a certain extent be attained by harrowing the drills freely in the cleaning and pulverizing of the soil. The dung will also be loosened and the soil intermixed by running the plough along the drills to open them for the reception of the sets or plants as already described. The drill system, applying the dung immediately under the plants, has long been followed in Galloway, to the total exclusion of every other; and the Galloway farmers have been very extensive and, until lately, successful growers of potatoes.

THE END.

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